THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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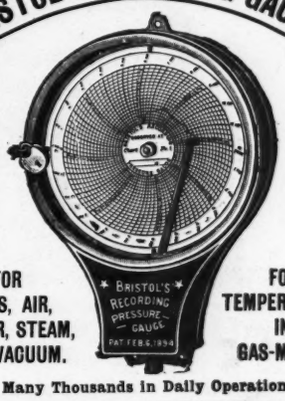

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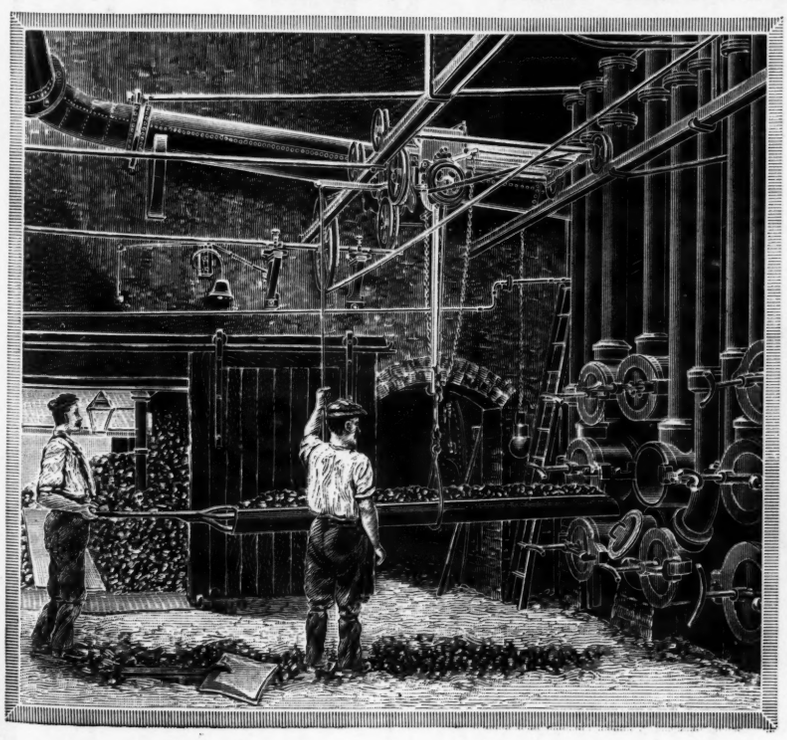

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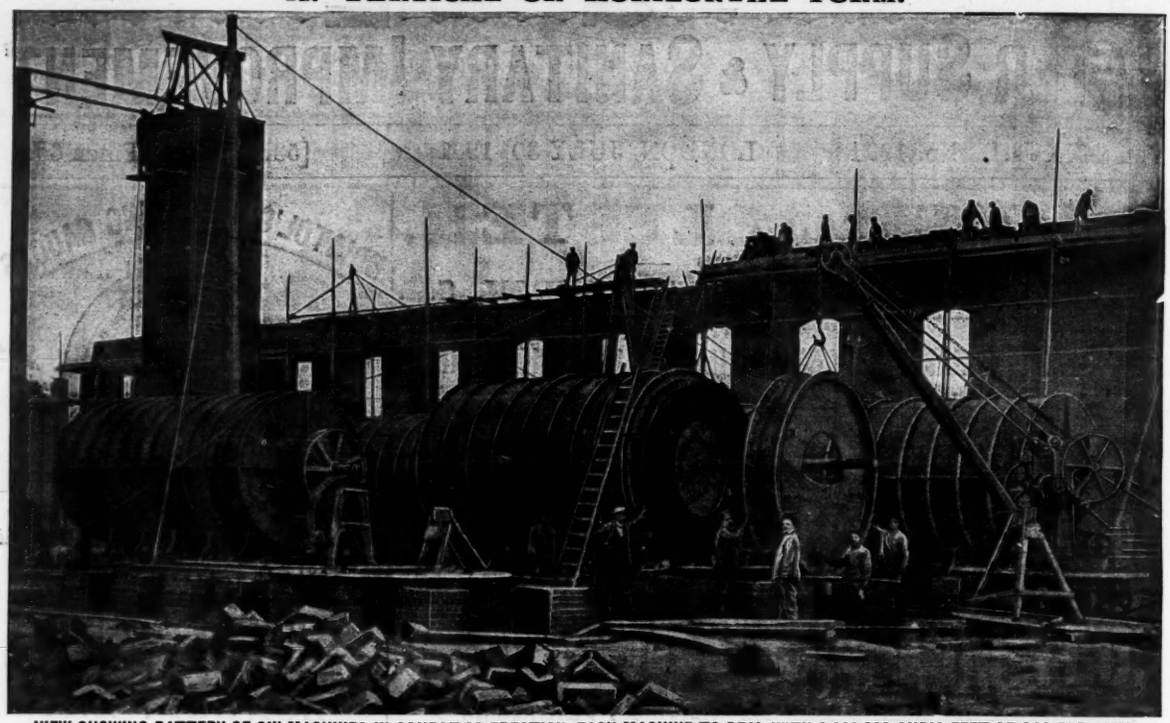

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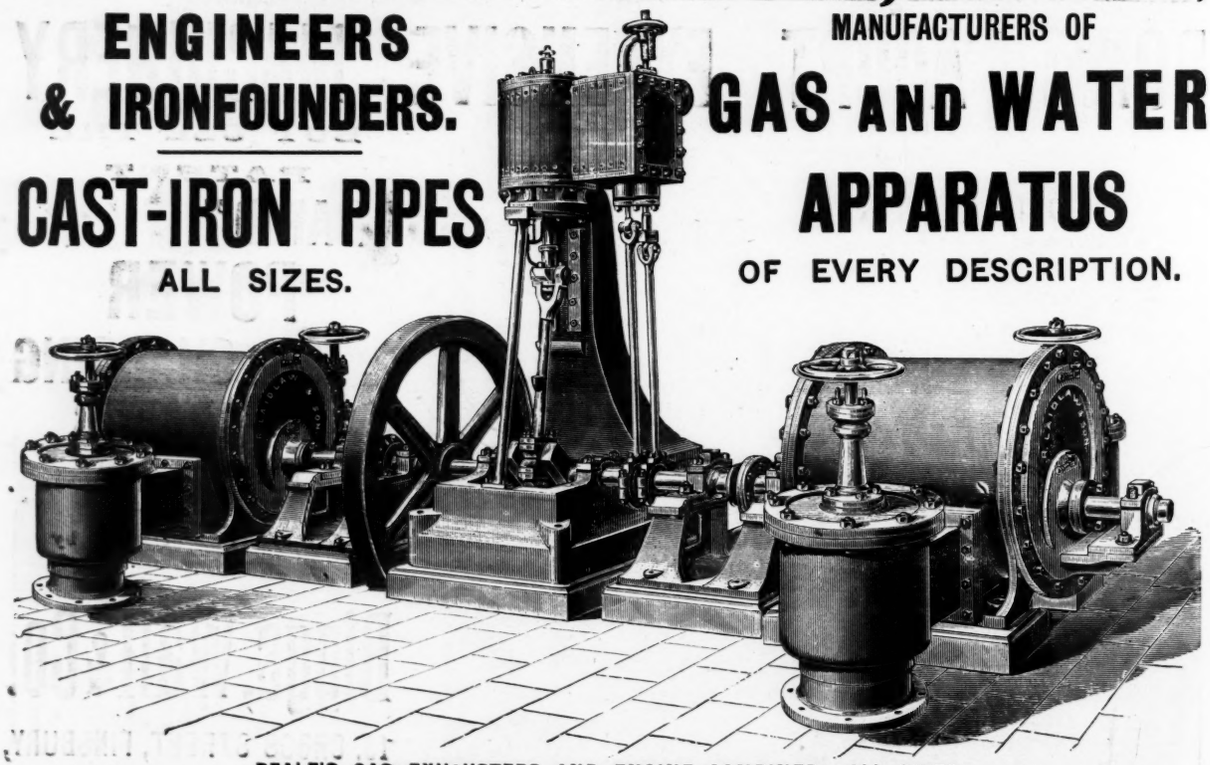

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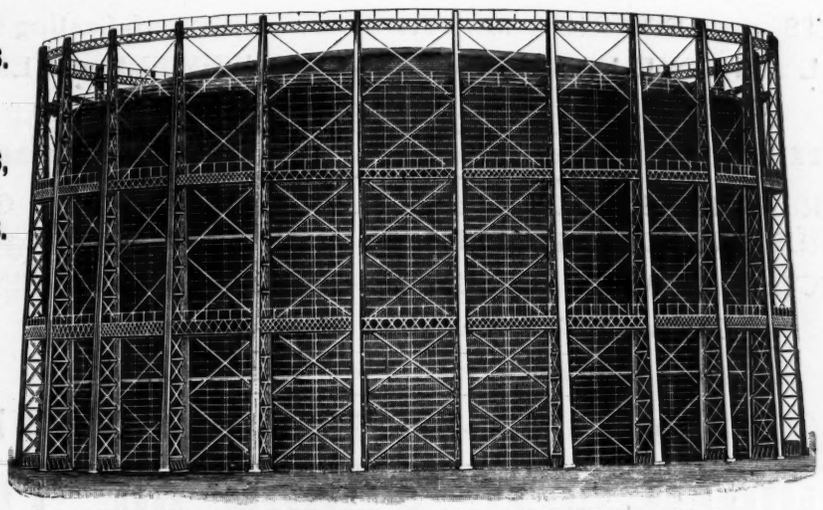

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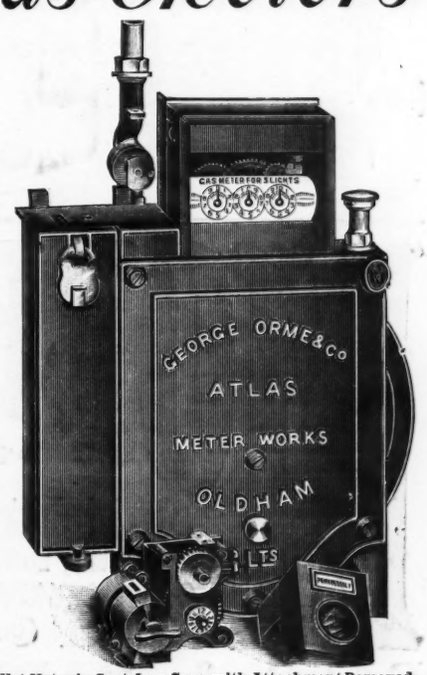

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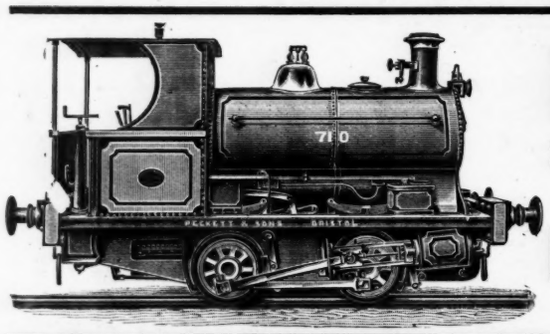

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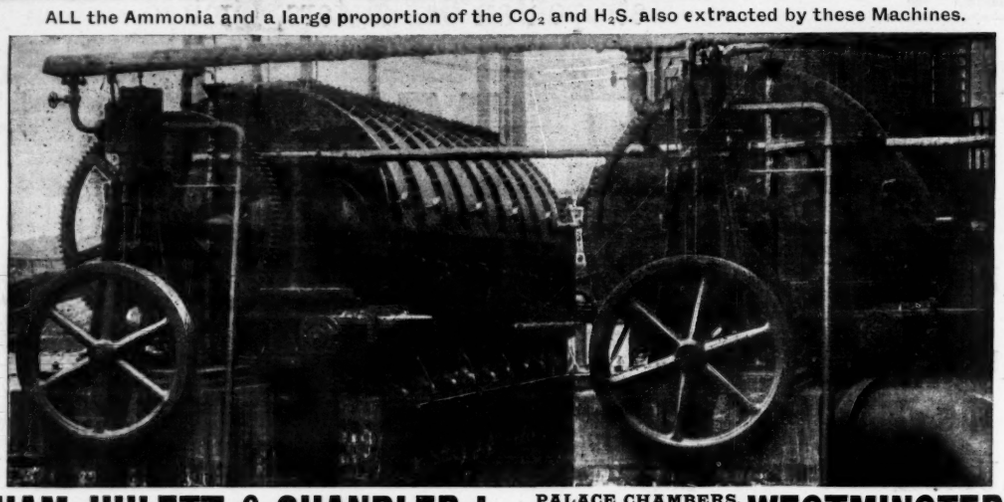

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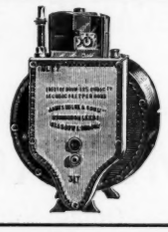

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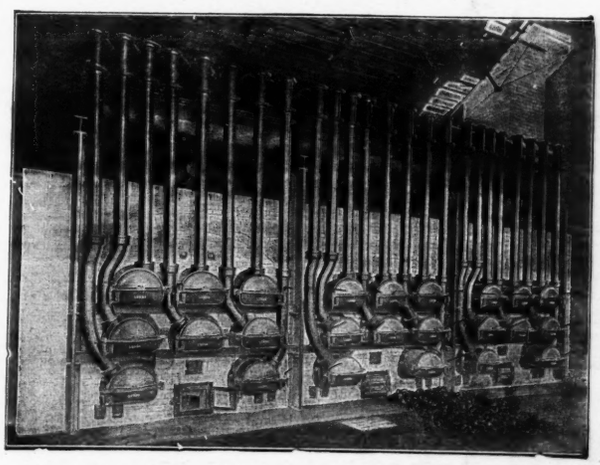

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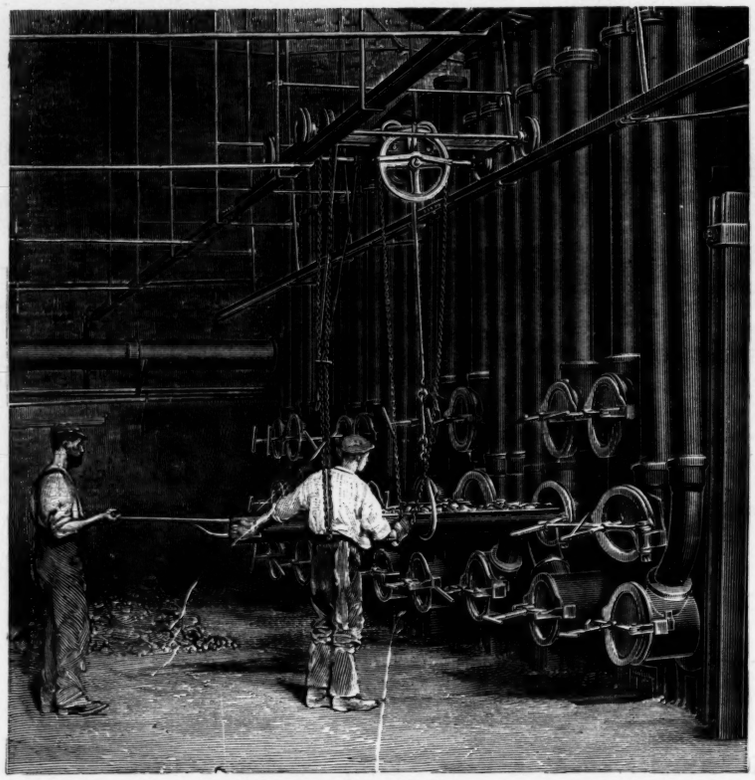

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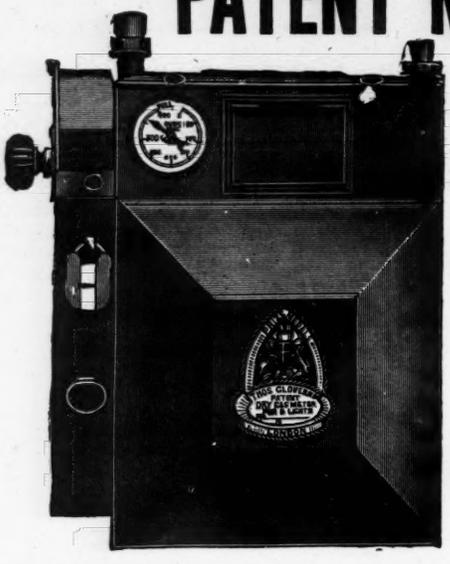

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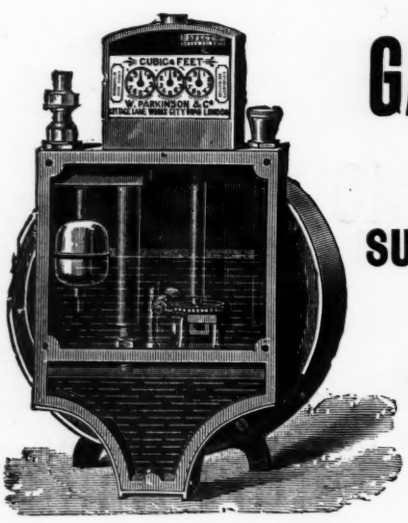

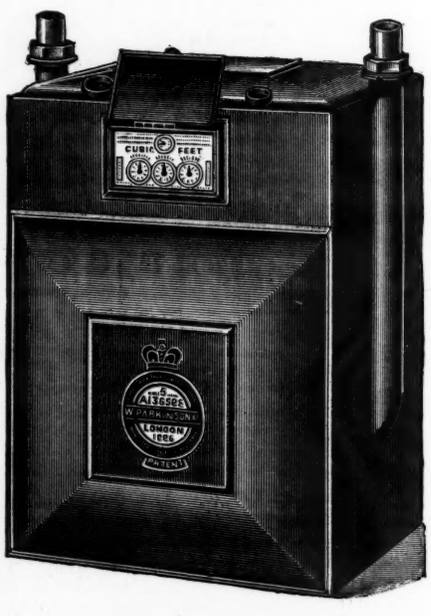

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

VOL. LXXVIII., No. 1994.—TUESDAY, JULY 30, 1901.

EDITORIAL NOTES.

The Business Qualities of the English People.

ARE the people of the United Kingdom, as a rule, good men of business? We have been styled a nation of shopkeepers by those who meant the phrase for a reproach; but a better acquaintance with our commercial habits would have taught them that it was rather an undeserved compliment. For it is impossible to take a general survey over British commercial affairs at the present moment without receiving the discomforting impression that if a new Diogenes were to start off in search of a thoroughly good man of business and of his epoch, the search might be both long and fruitless. Take the House of Commons, as a starting-point. Are the methods for the so-called despatch of business, and the transactions of that collection of British notables, such as any reasoning being could admire? What is worse even than the drivelling proceedings of many representatives of the sovereign people in Parliament is the consentment thereto of the newspaper-reading electors in town and country who sent them there. It is not as though the electors of the United Kingdom were left in ignorance of the acts and defaults of their chosen legislators. Far otherwise, indeed, with all the newspapers taking more notice of the flower worn by a politician in his button-hole than of the vicissitudes of a great national industry. Let two ex-Ministers of State exchange a whisper under the noses of the reporters, and the momentous incident is flashed forth to the world, commented upon, joked about, lampooned, served up with every variety of journalistic sauce. If a small professional politician, whatever his quality, can once succeed in entering Parliament by the neglect or mismanagement of his opponents, his silliest vagaries are eagerly described and magnified into events. It is no palliation to say there are more good men than charlatans in Parliament; since it is more in the power of the latter to work mischief than it is in that of the former to do positive good. The power of individual members, inspired by all sorts of motives, to seriously interfere with the statutory arrangements of large or small undertakings is doubtless constitutional; but it is scarcely business.

If we turn to the great Departments of State, the aspect of affairs is not more reassuring. The arrangements by virtue of which statesmen belonging to the parliamentary majority are charged with the conduct of the operations of the Local Government Board, the Board of Trade, or the Treasury, work fairly well in these examples; because the duties of such offices do not greatly surpass the ordinary ability and experience of educated and substantial gentlemen. It is very different, however, with such Departments as the War Office. Lacking a competent head, any organization of this kind is of necessity compelled to make shift with Committee or Auditors' management. "Government "by a Finance Committee," wrote a correspondent of the "Standard" recently, "is both expensive and vexatious— "expensive because it often results in a cheeseparing "economy, which leads to saving sixpence in one direction "and spending pounds in another; vexatious, because those "who have to carry out the executive details of administra- "tion find themselves hampered by the interference of those "who have no technical experience, but who regard every "proposition put forward from a purely economical point "of view." This kind of foolishness runs through all the ramifications of English administrative and industrial life. Writing of the Army, the same correspondent remarks: "No "manufacturer would allow his book-keepers to superintend "his workshops, and interfere at every turn with the prac- "tical men at the head of them." Indeed, they do—when it is a Company. But, as this writer sees, this is an ill fashion. "The great evil of all British administrative "bodies, from the Chief Departments of State to the "Borough Council, is the tendency to place the supreme "authority in the counting-house clerks, rather than in the "hands of the heads of the executive branches. No busi- "ness conducted on these lines would prosper." Yet this is how countless British undertakings, representing large investments, are now being mismanaged.

A huge industrial undertaking, the successful conduct of which requires the closest knowledge of the insides of half-a-dozen different trades, is trustingly confided to a barrister who never practised; perhaps with an advisory committee of shareholders with a money-lender at their head. Probably, the concern will drag along somehow until, if it is not protected by statute, it will be wound up by an Official Receiver. What is there in the smallest degree businesslike in all this? We must be, as a people, hopelessly destitute of the rudiments of the shopkeeper's craft to permit this kind of thing to go on. While the people are amused with the empty verbiage of politics, as Professor Meldola just recently told the Society of Arts, the plodding Germans, who are not curious in such matters, have struck the prosperity of India a deadly blow by perfecting the manufacture of synthetical indigo. Pick up any Imperialist newspaper, and the chances are that you will find in it telegrams from the ends of the earth relating to the intrigues of Russia in Central Asia, reinforced with impassioned exhortations for the British Government to "do something"—to fire off a gun or two, at least—to show a perfidious Continent that the nation is determined to defend its Eastern possessions; but not one word about the industrial victories of the foreigner, won by working while Englishmen are talking politics.

So it is all through. Whether by means of the Birmingham University, or by other means, it is necessary to amend the national conceptions as to the things that really matter; and to restore the primitive faith in the virtue of the cobbler sticking to his last. Read what is at present being written in the newspapers about the condition into which certain highly respectable railway directors, without a scrap of knowledge of their business, have brought the English Railway Companies. It is not only the national services that need reorganizing upon a business basis, but business itself, more particularly when carried on upon the joint-stock system, that requires to be restored to the traditional shopkeeping standard of efficiency. As matters are, the head of a vast manufacturing and trading company may be a far worse business man than the struggling keeper of a suburban oil-shop.

Report and Accounts of the Gaslight and Coke Company.

IN another column we give the text of the Directors' report and the accounts of the Gaslight and Coke Company for the last half year. As already announced, according to custom, the profit balance available for distribution amounts to £429,751, out of which the Directors recommend payment of a dividend on the ordinary stock after the statutory rate of £4 8s. per cent. per annum, carrying forward £97,993. The profit balance for the corresponding period of last year was £626,603, and the sum carried forward was £296,755. The amount of the net revenue for the half year was only £208,180, compared with £433,269 for the corresponding half of 1900. It will take £331,757 to pay the full statutory dividend recommended, so that the deficiency has to be made good out of the undivided balance. The actual net earnings of the undertaking have therefore been only at the rate of £2 12s. per cent. per annum. The report goes on to confess to a reduction of 4·05 per cent. in the gas consumption for the half year, which is attributed partly to the material increase in the price of gas, and partly to the fine weather of last winter. Still, the Directors claim a satisfactory increase both in the number of consumers and of gas-stoves in use in the district, which they hope will bring in more money when the objectionably brilliant weather behaves itself with greater consideration for the interests of the Company.

The immediate result of this shrinkage in the demand for gas has been the shutting down of two of the Company's more expensively worked stations. Something, evidently, had to be done to meet the adverse circumstances of the times. The heavy reduction of profit on the half-year's trading is referred to the failure of the increase in price by 6d. per 1000 cubic feet to set off the higher net cost of coal by 1d. per 1000 cubic feet, combined with the "large "and necessary expenditure on reconstruction works," and the reduced sales of gas. This, in all conscience, is a painful

enough confession. If the increase in the charge for gas checked the consumption, although it did not pay for the dearer coal, what, it may be inquired, would have been the effect of a greater increase such as might have covered this extra working expense? Is it, then, really true that the price of gas has more to do with the consumption than the Horseferry Road has hitherto professed to think? Again, what about those reconstruction works? Was it absolutely necessary to go about them at this period of high prices for all gas-works supplies, after having waited so long? What are they, that they must be pushed on at any cost now?

In reporting upon the capital circumstances in the undertaking, the Directors refer to the rejection once more of their Money Bill, to the failure of their latest stock issues, and to the consequent necessity of having recourse to temporary borrowing to a greater extent than ever before. Such a condition the Directors admit to be undesirable; and, in order to remedy it, they have under consideration a proposal for placing the ordinary stock at par, at the expense of the dividends payable in September and March next. How the proprietors will take this suggestion remains to be seen after its nature is more fully explained. It is announced that, having secured a reduction in the price of coal averaging 8s. per ton, the charge for gas will be lowered as from the beginning of next year by 5d. per 1000 cubic feet. This reassuring statement is sandwiched into the report between the references to the Directors' unhappy parliamentary experience. It is explained that the House of Commons was quite mistaken in supposing that the defunct Bill ignored the recommendations of Sir James Rankin's Committee. The proprietors are assured, on the contrary, that the principal provisions of the Bill "were directly intended to "give effect to such of the recommendations of that Com- "mittee as had not been the subject of special legislation." It is a great pity that so deplorable a misconception as that alluded to should have prevailed with the House of Commons. The Directors express "regret that they have "thus again failed to obtain from Parliament powers to "raise the capital necessary for the purposes of the under- "taking." The proprietors probably share this feeling.

This remarkable report is very full of all the chief points arising out of the accounts of the undertaking for the half year; but something remains to be said on the figures. There is no illusion about the dearness of the coal, which cost the Company no less than £1,159,913, compared with £833,451. The Company's Works Managers are to be complimented on having at last made an impression on the wages bill. All those extensive labour-saving appliances which the Company's Engineers have been so industriously installing for years, are beginning to tell. Why purification should be dearer—£41,636 to £55,049—is not apparent on the surface. Repairs and maintenance, of course, cover the reference in the report to reconstruction; and the entry has been swelled from £168,600 to £221,675. This is rather a strong order. Under the classification "Distribution of "gas," there are some significant figures. The mandate to economize has evidently gone forth; and the automatic meter supplies have accordingly been docked from £26,575 to £15,495. Rates and taxes have again risen seriously, from £120,172 to £133,859. With a shrinking profit, this is a noteworthy feature. The revenue from the sale of gas was forced up from £1,554,206 to £1,736,195. Coke rose from £387,332 to £408,617; but tar and ammonia have again proved disappointing. For tar to drop from £92,421 to £66,462, and ammonia to fall from £100,021 to £68,562, is not a comforting result.

In the detailed accounts, the heavy falling away of gas consumption overshadows everything else. True, there is still a growth in the numbers of consumers and gas-stoves in use, as the report avers; but the reflection will occur that the majority of these are small outliers, not likely to compensate for the serious loss of trade in the inner district. In the general balance-sheet, it appears that the value of the stock-in-trade has greatly increased; while the balance outstanding against the fittings account for automatic meter supplies has been reduced from £254,191 to £195,945. Although mentioned here last, the most striking change in the aspect of these accounts is to be found in the capital statement for the half year. Here the outlay on buildings and machinery in extension of works has been cut down to £1675; whereas the whole of the balance (with one small exception for land) has gone in new and additional mains, services, meters, and stoves. Any number of "morals" cluster round this revelation. Among other things, it may be the explanation of the absence from the report of any hint of the promotion of another Bill for next session. The check to the growth of the undertaking, however, is the more portentous disclosure of these accounts.

The Meeting of the North British Association.

THURSDAY last was a day of flood-tide in the history of the North British Association of Gas Managers. With a President, in Mr. W. R. Herring, of Edinburgh, of more than usual ability, and tactful as he is capable, and with the attractions to be found in the great International Exhibition, a good meeting was to have been expected. But expectation was more than fulfilled. The gathering was the largest we remember to have ever seen at any meeting of the Association. These are, however, but adventitious aids to success; the true gauge of the meeting is the quality of the proceedings. Applying this test, the conclusion must be come to that the Association has excelled itself—that it has set up a standard in the opening year of the century which it will be difficult for it to maintain. There is pleasure in the feeling that the success which was attained was not a haphazard one, but was manifestly the result of careful arrangement. Including the President's Address, there were four communications before the meeting. The President regarded a reduction in the illuminating power of the gas supplied as a question for consideration. He was followed by Mr. Yuill, of Alloa, with a paper showing what can be done by means of benzol enrichment of gas. Then a purely scientific subject was discoursed upon by Professor Ivison Macadam. And, last of all, an engineering subject was submitted in the paper by Mr. Creeke. There was thus variety sufficient to suit almost all conceivable tastes. Abstractly stated, the subjects were: The economics of gas production; the laws which govern light; and the application of mechanics to processes of gas manufacture. It is difficult to entertain the belief that the programme was not built up with the intention of producing a certain effect.

Mr. Herring's address was more informative than is usually to be found in such communications. His experience has been so wide, and his observation so pointed, that he is able to crystallize, and bring into order, that which another would probably leave indeterminate. As he professed to make it, his address was indeed a sifting of processes, a separation of the good from the bad; and many will profit from the work of his master-hand. Notably has he put the whole world of gas producers under debt to him by his statement of the situation, in the prescient remarks that "at the present day nothing can be taken for granted," and that nothing is to be accepted "as perfect until we are con- "vinced of the impossibility of doing it in a better way." There is here the frankest acceptance of all the conditions of environment, and the spirit to face all the difficulties which beset the gas industry. With a determination such as this dominating its leaders, and being translated into action by its working, the gas industry might well look forward to the future with more than equanimity.

Mr. Yuill is known as an advocate of enrichment, in which cause he has fought many battles. He seems to be conscious that enrichment no longer holds the place it did—the fashion of the day being towards a low-grade gas; and so his attitude was: If you want to enrich, I will show you how to do it, and what you may expect. He put enrichment by benzol on a well-reasoned basis, which it has not always hitherto occupied. The removal of doubt is the most certain way to promote truth; and, viewed in this light, Mr. Yuill's paper should have a far-reaching effect.

The Association have, after seven years' application to the subject, come to a decision upon the matter of the standardizing of meter-unions. It is true they did so before, and went the length of having a set of standards prepared, but found out afterwards that they had been forestalled by the Board of Trade. That they have not been able to get their standards adopted is due to the circumstance that there is much greater uniformity in meter-unions than was suspected. Clearly it was the duty of the Association to adopt the union which could be brought into use with the least trouble. They have done so by conforming to existing circumstances rather than by insisting on others conforming to their ideas. By doing this, they have secured their object. Now, when the end has been attained, is the fitting time to acknowledge the services of Mr. J. N. Myers, of Saltcoats, in raising the question. He has made the path easier for himself and others; and for doing so he deserves the thanks of his fellow-workers.

The Coke Market.

WRITING a fortnight since on the victory of the railway companies in regard to their supplies of coal for the ensuing year, we remarked upon the imminence of a renewal of the contracts annually entered into by the London Gas Companies with their principal customers for coke, but forebore from offering any opinion as to the price that sellers might, in the present condition of the trade, fairly ask and expect to receive. It was not then known what would be the minimum price put upon their coke by the Directors of the Gaslight and Coke Company, who for some years past have adopted the practice of offering a certain quantity to be tendered for at or above a specified figure, for delivery during the year commencing Oct. 1. The tender forms have now been issued; the quantity offered being 380,000 tons, at a minimum price of 14s. per ton.

When this price was made public, our own feeling was that if the London Companies were able to sell their coke at such a figure, they would do uncommonly well, but that it was extremely doubtful—considering the drooping condition of the fuel market, the presence of considerable stocks, and the general easiness in trade—if buyers would commit themselves for twelve months to what was, it is true, about a fair current price. The current price of Durham gas coal is 10s. 6d. to 11s. per ton f.o.b. Tyne; but no one is making contracts at such figures. Why should coke buyers be less prudent? The view we held, but were careful not to express, was shared by the "Iron and Coal Trades Review," in which it was remarked that "the opinion in the trade is "that it [the price] is too high for delivery over the period "specified"—and has been, we understand, justified by the event. The date for the submission of tenders is past; and, from the reports that reach us from the market, it would appear that only a small proportion of the quantity offered can have been bought—most of the large consumers declining to tender.

The difference in the coke market now, as compared with a year since, is, in fact, fully as striking as the contrast presented by the coal market to-day with its condition at the end of last summer. Last year, the Metropolitan Gas Companies caught the top of the market with their coke; the minimum price fixed being 22s., which was freely agreed to by purchasers, many of whom have, however, found their contracts a hard row to hoe. This year, buyers are fighting shy of 14s. per ton—which, it may be remarked, is well above the average price, though 1s. lower than that obtained in the year commencing October, 1899, when the fuel market was rapidly becoming inflated. It is not many years since coke contracts were being made at less than 10s.

It is unfortunate that the tender price fixed by the Gaslight and Coke Company has missed the mark. The coke market is more easily thrown into confusion than brought again to a state of equilibrium; and buyers will be in a very non-committal mood now until the situation is clarified. Probably nothing would more readily put matters on a satisfactory footing than the arrival of the principal coke producers, both Metropolitan and Provincial, at a common understanding as to the price at which to sell—a policy we have always advocated, and one that should, in our opinion, be followed first rather than last. If everyone is going to play off his own bat, someone is sure to make a very poor score. Developments will be watched with a good deal of interest, not altogether unmixed with concern.

Militant Trade Unionism in America.

A GOOD deal has been heard in this country of the admirable qualities of the American workman—how clever he is, how contentedly he labours for ten hours a day, how enthusiastically he welcomes every mechanical device for saving labour and increasing production, and how satisfied he is to receive high wages in exchange for his toil! It has usually been the British newspaper writer who has dilated upon this theme, to the disparagement of the British workman, not enjoying more than a nodding acquaintance with specimens of the real working men of either, or any, nationality. Those whose knowledge of mechanics and unskilled workpeople is closer, have usually found them all and everywhere branded with the same old marks of humanity, which they are themselves also conscious of bearing. We have chronicled the latest outbreak of the New Trade Unionism in the American steel industry. It is the same old story, which was told to a close here in 1889. Employers shut their eyes to the political aspect of Trade Unionism, allowing themselves to be lulled into a false sense of peace, and covered by the demagogues' professions of desire for nothing more than fair dealing as between man and man. Then, when the leaders judged their warlike organization to be strong enough, the mask was thrown off, and a dash made for supremacy.

The most noteworthy failure of Trade Unionism to justify the expectations of its friends is displayed in the history of the strike and lock-out at the works of the National Cash Register Company, at Dayton, Ohio. The narrative of this remarkable attempt to harmonize Capital and Labour has been given in the "JOURNAL" by Mr. E. W. T. Richmond. Unfortunately, the serpent was allowed to enter the new Eden, in the shape of a freely sanctioned Trade Unionism; and as a result the works are closed. It appears that the President of the Company tried the old plan of not taking any notice of the Trade Unions. They were not officially recognized; but neither were they prohibited. The usual result followed. The mechanics organized themselves into Unions, to the number of twenty-four; and then the inevitable stage of "trying it on" was entered upon. Not having a real grievance of their own, the men permitted their Society officials to hunt some up, while nursing a number of "demar-"cation" disputes. The Company supplied the towels for the men's lavatory, and had them washed, as an act of mercy, by a needy old woman. As she was not a Trade Union, the noble Unionists demanded that the work should be taken away from her and given out to a Union laundry, which was done. Then, some brass tags attached to doors were discovered to have come from an "unfair" maker. Demanded, that these tags should be Union-made. Then, some aprons supplied to the workmen were made at a charitable institution. Demanded, that the articles should be supplied by a Union firm charging double the price. These requests were conceded. Lastly, the Moulders' Union demanded that two men who had been "laid off" should be reinstated. Hereupon the management thought the time had come to assert itself, and the President declined to give the promise asked for. Then the officials of the Moulders' Union ordered a strike; and all the members of the twenty-four Societies obeyed. The gates were closed upon them; and when they are opened again in all probability no Trade Union men need apply for employment. This we learn from "Progressive "Age," which quite rightly regards the incident as of high significance. All that the wages system, combined with Trade Unionism, could be arranged to do to render the men contented, was done at Dayton. This is the consequence.

WATER AFFAIRS.

Sir J. Blundell Maple's Water Bill.

IN accordance with notice previously given, Sir J. Blundell Maple introduced last Tuesday his Bill "to vest the under-"takings of the London Water Companies in a single public "authority," and it was read the first time; the second reading being put down for next Tuesday. Before this stage is reached, however, it will have undergone the scrutiny of the Examiners, to whom it was referred last Friday, who cannot do otherwise than report that the Standing Orders of the House have not been complied with in regard to it; and then the matter will probably be referred to the Standing Orders Committee. As the House is expected to rise on the 17th prox., the measure cannot make much progress, even supposing it is considered of sufficient importance to justify a suspension of the Standing Orders for the purpose. In his attempt to reorganize the system under which London is now, and has for very many years been, supplied with water, the honourable member for Dulwich is associated with Mr. Cust, Mr. Kimber, and Mr. Arthur Morton, representing respectively Bermondsey, Wandsworth, and Deptford in the Conservative interest. It may be assumed, therefore, that the subject, large as it unquestionably is, has been approached with proper regard for vested interests, and with an earnest desire to present for consideration a solution of a question which has given much trouble in the past, and is at this moment engaging the attention of a Government Department. Though the Bill has been ordered to be printed, official copies were not obtainable at the close of last week. We are, nevertheless, in a position to give to-day an indication of the scope of the measure.

In an introductory memorandum it is set forth that the Bill has been drafted "with the object of meeting the wishes

"of water consumers who desire that the water supply of "the Metropolis and adjacent districts should be vested in "a public central authority;" and it is added the effect of its being passed will be that "all economies of manage- "ment, better supply, and reduced cost of water and service, "will be for the benefit of consumers." The preamble recognizes the expediency of the transfer of the water undertakings to such an authority, the proposed constitution of which is explained in the opening portion of the Bill. It is to be called the Water Council, and is to consist of a salaried Chairman and Vice-Chairman, appointed by the Local Government Board, and 69 members who are to hold office for three years. On this Council the London County Council will have sixteen representatives; the Common Council of London and the Councils of the new Metropolitan Boroughs, one each; the Councils of Middlesex, Kent, Hertford, Essex, and Surrey, four each; and the Thames and Lea Conservancy Boards, two each. It is proposed to pay the Chairman £3000, and the Vice-Chairman £1500 a year; and the Council are to have power to appoint a Deputy-Chairman, at an annual salary of £500. Though the Council is to consist of 69 members, the actual work, except the borrowing of money and the promotion of Bills, is to be done by an Executive Committee of ten, who are each to be paid £250 per annum; and the Chairman, Vice-Chairman, and Deputy-Chairman of the Council are to hold these offices upon the Committee.

To a body constituted as indicated above the undertakings of the eight London Water Companies are to be transferred on Jan. 1, 1903, and thenceforth held "for the benefit of the "inhabitants of the Metropolitan water area." The duties of the new Council will comprise the improvement of the existing works; the extension, so soon and so far as practicable, of the constant supply throughout the water area; the making and enforcement of bye-laws for the prevention of waste; and the conveyance of water to, and its distribution within, such area, "without regard to the source whence it is "derived." In consideration for parting with their property, the stock and share holders of the several Companies are to receive an amount of water stock, to be created under the Act, sufficient to produce the same income as that obtained by them in the financial year next before the passing of the Bill. In the case of holders of ordinary shares or stock on which a dividend at less than the maximum statutory rate was paid for that year, an addition is to be made of such further amount of water stock, in respect of a prospective increase of dividend, as may be determined, in default of agreement, by an arbitrator to be appointed, on the application of either the Council or the Company concerned, by the President of the Institution of Civil Engineers. In reckoning the income of share or stock holders in the New River Company for the purposes mentioned above, no account is to be taken of any income received by them from property not by the Act transferred to the Council; and any difference arising is to be settled by an arbitrator.

We have shown how the stock of the Council is to be used, and it now remains to see where it is to come from. This is explained in the concluding portion of the Bill, wherein it is provided that the Council shall forthwith create a sufficient amount of stock, to be called London Consolidated Water Stock, bearing interest at the rate of 3½ per cent. per annum, to provide the consideration-money for the transfer of the undertakings. If at any time the Council have reason to apprehend that their income will be insufficient to meet the interest payable on the water stock and other payments to be made out of the revenue for the year, they may cause the amount of the deficiency to be estimated, and raise the money by contributions from the constituent authorities other than the Conservators of the Thames and Lea. If any difference arises concerning the precept, it is to be referred to a single arbitrator under the Arbitration Act, 1889. With the view of providing the Council with funds to enable them to conduct their business before the receipt of their water-rents, they are to be empowered to apply to the Bank of England for pecuniary assistance up to £500,000; and the sums so advanced are to be a first charge upon the Council's property. In addition to any stock authorized by the Act to be issued, the Council may create water stock not exceeding £1,000,000, and apply the whole or a portion of it to any purpose to which capital is properly applicable. The other clauses of the Bill relate to the Directors, officers, and servants of the existing Companies. Every Director who has held office for not less than three years immediately before the transfer is to receive a life annuity equal to his yearly salary or fees, on an average of this period; and all the present officers are to be transferred to the Council, who may, however, abolish any office which may be considered as unnecessary. Provisions are made for the appointment of such officers and servants as may be required, the assignment of their duties, and the award of their salaries; and others refer to the making up and presentation of the accounts and the promotion of Bills.

The foregoing is an outline of the scheme with which Sir Blundell Maple has forestalled the Government. We need not now discuss the judiciousness of rushing in, at this period of the session, a Bill dealing with a subject in regard to which the President of the Local Government Board has so very definitely announced the intentions of his colleagues. Some expression of the views of the House thereon may be expected when the Bill comes up for second reading—should it ever reach that stage. In the meantime, it may be remarked that the ordinary organs of public opinion do not appear to have taken very much notice of the measure; the phase of the question of the London Water Supply with which they have been most concerned lately having been the inconvenience caused by the superabundance of water brought to the Metropolis by the severe thunderstorm that occurred last Thursday.

THE GAS SECTION OF THE ENGINEERING CONGRESS.

THE official programme of the International Congress, which is to be held in Glasgow from Sept. 3 to 6, has been issued by the General Secretary (Mr. J. D. Cormack); and it contains a considerable amount of information which will be found of great immediate and future service to delegates and members. There will be a little opening ceremony on the first day of meeting at 10 a.m., when the President (Mr. James Mansergh, F.R.S., the President of the Institution of Civil Engineers) will receive the foreign delegates and honorary members, and deliver a short address in the Bute Hall of the University.

The Natural History Lecture Theatre has been set apart for Section VIII. (Gas), in the proceedings of which readers will be mainly concerned, and over which Mr. George Livesey will preside. On the first day, the time to be devoted to technical work will be from 11 a.m. to 1 p.m. In the afternoon, visits will be paid to the gas-works at Dawsholm and the new gas-works at Provan. In the evening, there will be a reception by the Lord Provost and Corporation in the City Chambers, at 8 p.m. Both on Wednesday and Thursday, three hours will be devoted to the consideration of papers—viz., from 10 a.m. to 1 p.m. In the afternoon of Wednesday, several engineering works will be thrown open to inspection; and on Thursday, the visits include collieries in the Hamilton district, the Broxburn oil-works, the gas exhibits in the Exhibition, and engineering works. At 9.30 p.m., there will be a ball in St. Andrew's Halls. Excursions to various places of interest have also been arranged for Wednesday and Thursday afternoons and all day Friday. The Visits to Works Sub-Committee for the Gas Section is composed of Mr. G. T. Beilby, Mr. G. R. Hislop, and Mr. J. W. Helps, with Mr. W. Foulis as Convener.

As already announced, Mr. Livesey will be the Chairman of the Gas Section, and Mr. W. Foulis, Mr. W. R. Herring, and Mr. T. O. Paterson the Vice-Chairmen, with Mr. J. W. Helps as Honorary Secretary. In addition to Mr. Livesey's short address (which will be submitted to discussion), the authors and titles of papers are now announced as follows:—

A. ROTHENBACH, jun., of Berne, "Automatic Lighting and Extinguishing Apparatus."

Dr. F. SCHNIEWIND, of New York, "The Production of Illuminating Gas from Coke-Ovens."

Dr. LEYBOLD, of Hamburg, "Electrolysis of Gas-Pipes, &c."

J. VAN ROSSUM DU CHATTEL, Amsterdam, "The Principles of the Proposed Construction of a Modern Gasholder for Amsterdam."

Paper prepared by the COMMITTEE from Particulars supplied by Exhibitors, "Lighting of the Exhibition by Means other than Electricity."

C. C. CARPENTER, of London, "The Application of the Unit System of Gas Manufacture to Its Purification."

W. R. HERRING, of Edinburgh, "The Construction of Inclined Retort Installations."

W. R. CHESTER, of Nottingham, on the "Transport of Materials."

Professor VIVIAN B. LEWES, of London, on "Water Gas as an Adjunct to the Manufacture of Coal Gas."

FERNAND BRUYERE, "Emile Gobbe's Process for the Production of Water Gas."

This is a substantial list for the brief space of eight hours; but the Chairman and other office-bearers may be relied upon to see that the time is so spent that the maximum of useful work is compressed into it.

ESSAYS AND REVIEWS.

OUR GUESTS FROM FRANCE.

Our guests from France—the members of the Société Technique du Gaz—have been and have gone; and as we sit down to thread together some notes of the events during their stay in this country—which even to them, pleasure-loving on the one hand and intensely studious on the other, was a perfect whirl of delight and exciting and instructive experience with no dull intermissions—we feel some amount of pride and gratification that the heads of our leading organizations and companies blotted out for the time all evidence of any disturbance of the domestic peace of the home gas industry, and combined for the entertainment of their visitors. This they did with open hands and gracious personal effort. Glancing back, from an independent standpoint, over the three days, we fail to see a flaw in the arrangements. They were complete so far as human endeavour could make them; and only the weather was fitfully unkind. The scale of the social functions, the almost anxious regard that was paid on all hands to details to ensure the comfort of the visitors during their inspection of works, and the advantage taken of frequent opportunities for showing them not only personal esteem but respect for the French as a nation touched their natural susceptibility, and they were not found wanting in responsiveness. The signs of their appreciation were as spontaneous and unaffected as they were unbounded; and one and all who, in degree large or small, contributed to their entertainment cannot fail to have derived unalloyed pleasure in having done so. To both givers and receivers the event will be a happy reminiscence. Let it not be imagined, however, that the success must all be placed to the credit of the Companies and organizations who were the hosts. There were the individuals who gave themselves up freely to the work of arranging the details of the visit, and, moreover, in seeing that they were faithfully carried out; and others who, connected with English Companies operating on the Continent, were assiduous in the work of interpretation for the benefit of the visitors unacquainted with our language. We might mention in the latter connection the names of Mr. R. S. Gardiner, the late Secretary of the Imperial Continental Gas Association, M. Salanson, the President of the Union des Gaz, Mr. W. Williams and Mr. W. B. Brady of the European Gas Company, and Mr. C. E. Brackenbury, of the Continental Union Gas Company. The Misses Woodall also won the attachment of the ladies in the party by their graceful attentions throughout the visit.

The visit originated with a desire that the annual congress of the Société Technique this year should embrace an inspection of some English Gas-Works. The Committee made known their wish through their colleague Mr. Gardiner, who, by the way, is the only foreign member of the Société who holds the distinction of occupying a seat on the Committee, and that alone is an indication of the affection and respect of the members for him. The wish was no sooner made known in the proper quarters than it met with the response which has proved to be generous beyond expectation.

The visitors journeyed last Sunday week from Dieppe, where they had been holding their congress; and all told the travellers numbered 93. Over night they stayed in Brighton, where they were on the following day to taste the sweets of the hospitality of the Brighton and Hove Gas Company. It was a source of regret to one and all of the English hosts that the President of the Société Technique (M. Alfred Lebon) had been too unwell to take his place at the congress, and that the engagements of M. Piaton, the Vice-President, would not permit of him joining in the visit to this country. However, a worthy deputy was found in M. Cornuault; and he had at his back the following members of the Committee: MM. Bigeard, Frère, Godinet, Marquisan, Thibaudet, and Visinet—the last-named of whom performed the secretarial duties.

The Brighton Company's Works and Hospitality.

A very few minutes after nine o'clock on the Monday morning, the visitors were prepared to commence their pleasant expedition; and there were conveyances in readiness to transport them from the Grand Hotel to the Portslade Gas-Works of the Brighton and Hove Gas Company. Even at that early hour, they found Mr. R. Hesketh Jones (who, in the absence of Mr. J. Birch Paddon, the Chairman, had been deputed by his colleagues on the Board to do the honours of the day) and Mr. J. Cash, the Engineer of the Company, prepared to escort them. The drive along the grand and almost unrivalled sea-front was enjoyed considerably. On arriving at Portslade the large company was divided—one party being conducted by Mr. Cash, and the other by Mr. John Paddon, jun., the Assistant Engineer. The Chief Inspector of the Company (Mr. A. Stanley Cooke) was also indefatigable in rendering assistance.

The coal-gas works are divided into three distinct sections, Nos. 1 and 2 of which are capable of a production of 1¾ million cubic feet each per day, and No. 3 section 2 millions. It was into No. 3 section that Mr. Cash's party entered. They inspected first the arrangements for dealing with the coal; and then very particular attention was given to the four sets of Humphreys and Glasgow's carburetted water-gas plant situated at the end of No. 3 retort-house. This plant is capable of producing 3 million cubic feet per 24 hours. The blowing plant and three engines and exhausters, each of 100,000 cubic feet per hour, were found in the adjoining engine-house. The purification is performed by six 50 ft. by 20 ft. vessels; and a 100,000 cubic feet meter records the production. The oil storage and relief holder adjoin the plant. The mixture of the carburetted water gas and coal gas takes place on the outlet-pipes of the station meters. It is unnecessary to follow the visitors through the whole course of their inspection; but points which appeared specially worthy of note may be recorded. Returning to No. 3 retort-house, an inspection was made of the Arrol-Foulis stoking machinery. Passing to the purifier-house, it was found that the purifiers are charged by hand; and the foul material is thrown into tro leys running on rails and wheeled away. Something new in the way of a rotary screen for dealing with the *débris* from the water-gas plant and furnaces was observed in the yard; and it was gathered that it was constructed by Messrs. Graham, Morton, and Co., but modesty did not disclose until a little pressure was applied that the designer was Mr. Cash. It was doing its work splendidly. The screen divides and deposits the material into separate waggons—dust falling through the first division, small coke through the next, and larger coke through the third—the clinker being shot out of the end. Something like 65 tons have been dealt with in a day; but 50 tons is given as its working capacity—seeing that, if the material is wet it has to go in slower. The finest of the material goes to the boilers; the coke to the brickmakers; the clinker is ground up for concrete. Going into No. 2 retort-house, it was seen that a hot-coke conveyor is under construtcion; the contractors being the New Conveyor Company. In this case, the trough is being made of steel instead of cast iron. In visiting the scrubbers, the original rotary ones constructed in 1870 by Mr. J. Birch Paddon were pointed out; and subsequent modifications of the same system were shown. In visiting No. 1 section, the strong and necessary sea defences were features of interest; the works being situated close to the shore. This section afforded a grand opportunity of judging the character of the machinery in use some years ago, and comparing it with present types. For example, there were the scrubbers already referred to, and the older forms of exhausters dating back to 1865. This section, too, is the only one in which the charging is done by hand; but it is merely used in the depth of winter. The first parts of the works were constructed some thirty years or so ago, when the present Chairman was the Engineer, and Mr. Cash was his Assistant. The latter has therefore had a hand in the development of the Portslade works from their inception. Their arrangement in distinct sections, with airy buildings, ample yard space, and ground to spare for extensions, were all points that struck our Continental visitors, and showed them the wisdom of the Company's advisers and the Chairman and Board of Directors. Before quitting the works, they were taken past the benzol tanks to the Maxim-Clark carburetting apparatus, which is occasionally used when carburetted water gas is not being made.

Returning to Brighton, the company were taken to the Royal Pavilion, where they were very kindly received by Alderman Hawkes, the Deputy-Mayor, in the unavoidable absence of the Chief Magistrate. The various apartments of this gaily embellished place, around which cling stories of days past, were inspected; and the features of the buildings were pointed out by Mr. Gardiner. Luncheon was served in the banqueting rooms; Mr. R. Hesketh Jones presiding—Mr. Cash, Mr. Paddon, jun., and Mr. Cooke occupying the vice chairs. The national flags and emblems of the two countries were in evidence; and the tables were florally decorated in charming style. The repast was immensely enjoyed; and then two toasts were honoured. In proposing the first, Mr. R. Hesketh Jones (speaking in French) said his colleagues of the Brighton and Hove Gas Company had delegated him to offer their visitors a most cordial welcome; and Alderman Hawkes, the Deputy-Mayor of Brighton, representing the municipal authority, joined with them in expressing the same sentiments. Mr. Paddon, the Chairman of the Company, had written to him regretting his inability to be present. "But," continued his letter, "please let me be fully associated with you in the hearty greeting and the welcome which I know you will accord to our friends from the Continent. Should the works at Portslade, which they honour by their visit, interest them, I shall be highly gratified. Please convey to our friends my sincere wishes that their visit to England will be in every way pleasant to them, and that their efforts for the improvement of their respective undertakings may lead to success and distinction." As the Chairman of the European Gas Company, and as one of the Directors of the Continental Union Gas Company and the Union des Gaz, he (Mr. Jones) offered to the managers who were attached to those Companies a cordial handshake and a hearty welcome. He drank to the prosperity and happiness of the Société Technique, and coupled with the toast the name of M. Cornuault. That gentlemen, responding in the name of his colleagues, warmly thanked the Chairman and the Directors of the Companies for so cordial a reception. He and his fellow members of the Société Technique had, he remarked, fully admired the well-planned works at Portslade, and they had been particularly interested in the water-gas plant. He individually mentioned all who had in any way contributed to the morning's pleasure, and said the remembrance of their visit would indeed be a happy one. He drank to the "Success of the Brighton and Hove Gas Company." The Chairman appropriately responded, and proposed

"The Mayor and Corporation of Brighton." He remarked that, although the Gas Company experienced very severe competition from the Corporation, who were the owners of the electric lighting works, he believed they were on the best terms of friendship. Alderman Hawkes made a cordial reply; one observation being that, while the Corporation were competitors with the Gas Company, they were not opponents, and besides, there were fields in which electricity could not beat gas.

From the Pavilion the visitors passed to the dome and the picture gallery; and then remounting the conveyances they were driven to the Gas Company's storage station at Black Rock, where were formerly situated the works of the old Brighton Gas-light and Coke Company, which was amalgamated with the present Company in 1882. At Black Rock, there is storage for 2,000,000 cubic feet of gas, and at Hove for 2,400,000 cubic feet. The trunk mains running to the storage stations from Portslade are 24 and 16 inches respectively. At this station the cleansing and repairing of cooking-stoves are carried on. They are first boiled in a solution of soda ash, and can be turned out equal to new in twenty-four hours. Stoves which had undergone a period of hard labour and specimens of the renovated article were shown; and the visitors were delightfully interested.

The company then returned to the Grand Hotel, where Alderman Hawkes wished them God speed and a happy visit. By 3.40 the party were all entrained for London; and as they passed from the Brighton station, they raised a hearty cheer for the representatives of the Company who had given them such a friendly welcome on their setting foot on English soil.

Banquet by the Anglo-Continental Companies.

Arriving at Victoria, the visitors were conducted to the Hotel Cecil (which was their headquarters during the visit); and later in the evening they found themselves in the midst of London life at Earl's Court, where they were to be the guests for the evening of the Directors of the Imperial Continental, the Continental Union, and European Gas Companies. It was meet that these three Companies (who are so intimately connected with France) should be the first to honour the visitors on their arrival in London. At the dinner, Mr. J. Horsley Palmer, who is a Director of the first-named Company, presided. On his right was M. Cornuault, and on his left Mr. W. G. Bradshaw, the Chairman of the Commercial Gas Company. Mr. Corbet Woodall, the Consulting Engineer to the Imperial Continental Company, was present; Mr. Gardiner, the late Secretary; and his successor (Mr. R. W. Wilson). Mr. R. Hesketh Jones, the Chairman, and Mr. W. Williams, the Secretary of the European Company, were also observed. Mr. F. W. Himing, the Secretary of the Continental Union, was unable to attend, owing to his absence from town; but most of the officials of that and the other two Companies were there to welcome their colleagues from abroad. The London gas industry was represented by Mr. H. E. Jones, Mr. C. C. Carpenter, Mr. H. D. Ellis, Mr. Frank Bush, and others.

The banquet was on a scale of magnificence which showed that expense had been a secondary consideration. The toasts were opened with the Health of His Majesty the King and President Loubet; and then the Chairman gave "Continued Success to the Société Technique du Gaz en France, and Health and Happiness to every Individual Member." He said that when it was heard in England that the Société were going to hold their annual meeting at Dieppe, many hopes were expressed by gentlemen connected with the gas industry here that the members might be induced to brave the perils and discomforts of the Channel crossing, and pay a visit to England as they did long ago. It did seem a long time (he thought it was thirteen years) since the Société did them this honour; and it was with the greatest satisfaction that he saw their hopes had been realized, and that so many members had accepted the invitation tendered them by his colleagues—the Directors of the European, Continental Union, and Imperial Continental Gas Companies. They had not forgotten the great courtesy and hospitality which a good many Englishmen received on the occasion of the Gas Congress in Paris last year. Though in England there was not a splendid Exhibition to show visitors through, still he trusted that their stay in England would be thoroughly enjoyed, that the gas-works which would be visited on Tuesday would be of exceptional interest to them, and that the day would not be far distant when they might be able to welcome the members once more to this country. He was not going that evening into the work of the Société Technique; everybody admitted and recognized the good that the Société and kindred organizations in England did in promoting the great gas industry with which they were all connected. And it was a great industry; he believed really it was the greatest industry of the world, considering that wherever one went no matter in what country, no matter how remote it was from Europe, he found gas giving light, warmth, and happiness to everybody using it. He said just now he was not going to touch on the work of the Société Technique; but he must say there was no doubt about the good that it did. The gas industry at the present moment had a vast number of competitors. There was a struggle for existence, and some very strong competition; and it was only by earnest endeavours on the part of gas engineers to learn from their friends and other engineers, and by the advances that were made in the gas industry of the world, that they were able to compete and become not only a living but a progressive industry. It was just in that regard that the Société Technique had taken such a strong part; and, if he might be allowed to say so, he had on many occasions read the proceedings at their meetings with the deepest interest, and many gentlemen in England had derived great benefit from the researches—the patient researches—which French engineers had made, and the results of which they gave to the world. He asked them to drink to the Société Technique, coupling with the toast the name of M. Cornuault.

In his acknowledgment, M. Cornuault made a happy speech. He remarked that the three Companies who had done the members of the Société the honour of entertaining them that evening were not, as far as they were concerned, Foreign Companies. From the fact that they possessed gas-works in France, and employed French engineers, they were essentially friendly and allied to them—in fact, they were Anglo-French Companies. He and his fellow-members could not think too highly of their English colleagues for their splendid reception. They had already shown them, under the guidance of Mr. R. Hesketh Jones, a model gas-works of average size, which had considerably interested them; and on the following day the doors were going to be opened of two very large works—one at Beckton, which had alone a productive capacity equal to that of the whole of the works from which Paris was lighted. As at Brighton, they would not fail to draw from these works examples which they would be able to turn to their profit. This was not the first time they had made a similar visit to England. In 1888, thirteen years ago, when the congress of the Société was held at Boulogne, they accepted, in fairly good number, the courteous invitation of their English colleagues to cross the Channel; and all those who took part in the visit preserved an ineffaceable souvenir of it. They remembered more especially the sympathetic figure of the Director who then welcomed them—Mr. H. M'Lauchlan Backler, that grand friend of French gas managers. Therefore it was not without emotion, which was shared by all who knew him, that he recalled his name to mind. Their Chairman had been good enough to mention the services which their Société had rendered to the gas industry, and had reminded them that the three Companies who had received them that evening had often availed themselves of its services. The Société thanked Mr. Horsley Palmer cordially for his testimony; and he might be assured that, in the future as in the past, all their efforts would be directed to the improvement and development of their industry. In the midst of the incessant struggle between the rival systems of lighting, and the difficulties connected with the renewal of their concessions, they were, and would be, powerfully assisted by the co-operation of the special organization formed some years ago under the supervision of the Presidents and members of the Committee of the Société Technique. He referred to the professional syndicate of the gas industry—the younger brother of the Société who walked hand in hand with it, and rendered to the industry the greatest service in professional tasks which were not essentially of a scientific or technical character. It was only right he should render homage. He therefore drank to the three Companies who were receiving them, and to their distinguished representatives. He drank also to the union of English and French gas engineers; and, if they would permit him, he would rise for the moment above purely professional interests, and drink to the union of the English and French nations.

There were no other speeches; and the festive party was then somewhat abruptly broken up in order to allow the visitors an opportunity of witnessing the closing scenes of the military spectacle "China." This ended a day which had, through the kindness of the several Companies concerned, given the visitors a full measure of enjoyment.

Visits to Beckton and East Greenwich—The London Gas Companies' Welcome and Entertainment.

The London Gas Companies—the Gaslight and Coke, the South Metropolitan, and the Commercial Companies—provided the programme for Tuesday, and right well and generously did they do their part in affording interest and enjoyment to the visitors. Throughout, the directors and officials of all grades associated with the three undertakings seemed to vie with each other in a friendly way in showing attention and courtesy to their guests. The day, which was one to which the visitors had looked forward with marked interest, broke with ominous signs of the excursion to Beckton and East Greenwich being spoilt by continued rain. Neither place is one in which a man of his own free will would, under ordinary circumstances, be landed on a wet day, even for the gratification of going over works renowned throughout the world for their vastness. As one of the French visitors remarked of Beckton, "It is grand, but it is not beautiful." However, the drizzle which was falling as the steamboat *Boadicea* left Westminster Pier soon after 9.30 a.m. fortunately ceased before Beckton was reached.

At Beckton.

In their passage down the river, the visitors were naturally eager for information as to the historic and other public buildings which flank its banks. As the boat approached the great piers of Beckton, which a little distance away look almost like huge works of defence, the strains of the "Marseillaise" reached their ears; and for this graceful act they were indebted to the Works Military Band, who during the visit, when occasion offered, rendered selections of music in a manner which does credit to their leader, Captain T. Wilton. The large party were received on the landing-stage by Mr. T. Goulden, the Engineer, and his assistants, one and all of whom, it may here be said, exerted themselves to their utmost to make the visit of supreme interest; and they

certainly succeeded. The Board were represented by Mr. Corbet Woodall; and the headquarters of the Company by the General Manager (Mr. J. W. Field), Mr. G. C. Trewby, Mr. G. F. L. Foulger, and Mr. D. M. Watson—the last-named of whom had kindly undertaken a large part of the preliminary work in connection with the day's excursion. The Board of the South Metropolitan Company were represented by Mr. Robert Morton, Captain T. B. Heathorn, and Messrs. H. Austin and J. Butcher (the Workmen Directors).

At the head of the old pier, the numerous company found the works railway waggons furnished with seats and canvas roofs for the purpose of conveying them, with as little fatigue as possible, over the extensive works; and right welcome and considerate they found this act. The visitors were first taken along the viaduct to the new pier, and without leaving the trains they inspected the system of unloading coal by means of the huge hydraulic cranes and grabs. A ship was in course of being discharged. The coal unloading capacity is 14,000 tons a day; and during last year 1,200,000 tons were raised. The maximum average rate for the discharge of a vessel has approximated to 230 tons per hour. Proceeding along the viaduct and down the decline, the visitors were taken past No. 9 holder, which is the largest on the works, having a capacity, in round figures, of 8 million cubic feet. The crown was undergoing a little repair, and the holder was consequently down, which gave the French engineers an opportunity of having a better view of the guide-framing. Close by this large holder, they had an example of the old heavy columnar form of construction. At this point, there was a parade of forty of the works horses (which were gaily decked for the occasion by the French colours) and 29 locomotives. The ladies particularly found this a delectable part of the programme. Then there was a smart display by the works Fire Brigade; and the works Ambulance Corps followed with evidence of their splendid training and efficiency. In the provision of these displays, Mr. Thomas Wilton, of the Products Department, very greatly assisted.

In one of the buildings which were erected some years ago, and which were then designated by the men "Blackleg Square," but which in these days are devoted to peaceful purposes, the company—numbering some 150—sat down to luncheon under the chairmanship of Mr. Corbet Woodall, who in the name of the three London Gas Companies, "without words, but with a full heart," wished them welcome. Mr. Woodall was supported by Mr. Field and M. Cornuault; the vice-chairs being occupied by Mr. H. E. Jones and other representatives of the London Companies. Mr. Carpenter, to the regret of his colleagues, was not able to be present. Everywhere there was a blending of the flags of England and France; and, by the way, the French tricolour floated during the day from the top of the clock tower. Selections of music were played by the band during the lunch, under the conductorship of Mr. T. Bidgood.

After luncheon, the gas pumping-station was visited, and from explanations by Mr. Foulger and Mr. Goulden, the visitors learnt that the Beckton works on a winter's day produce about 61 million cubic feet of gas; but it is no use storing this gas at Beckton because it is so far from the point of consumption. It is therefore pumped to London at a pressure equal to 30 inches of water (48 inches has been experimentally pumped by part of the plant) and exhausted at nine different up-town storage stations into 37 gasholders allocated for the gas made at Beckton. For conveying the gas, there are two 48-inch high-pressure mains, which are now capable of passing upwards of 4 million cubic feet per hour. In all, there are 29 miles of 48-inch mains. Re-entering the train, the party passed along the incline to the viaduct, and along the new coal storage viaduct (with a capacity for 230,000 tons) to inspect the interior of a recently reconstructed retort-house; and by those familiar with Beckton, it was noted that a new departure had been made—the long held-to settings of nines having given way to a differently arranged setting of tens. We were informed by the Engineer that by this departure, worked as it is by a most excellent installation of West's compressed-air machinery, the capacity of the house had been increased fully 33 per cent.—from 3 to 4 millions, while marked improvement in carbonizing results had been obtained. This is a most important matter, as it means putting a 33 per cent. increased productive power to Beckton, with an insignificant expenditure of capital. Time running out, only a flying visit could be paid to a recently reconstructed purifying-house; the main feature in this being the abolition of the water seal—its place being taken by indiarubber joints. The carburetted water-gas plant (of 10 million cubic feet capacity) came in for considerable inquiry. It was observed that the plant is at the present time being enlarged. The chemical works (which are not often thrown open to inquisitive inspection) were free to the visitors on this unique occasion. The route which the visitors took through the chemical works is shown by dotted line on the accompanying plan.

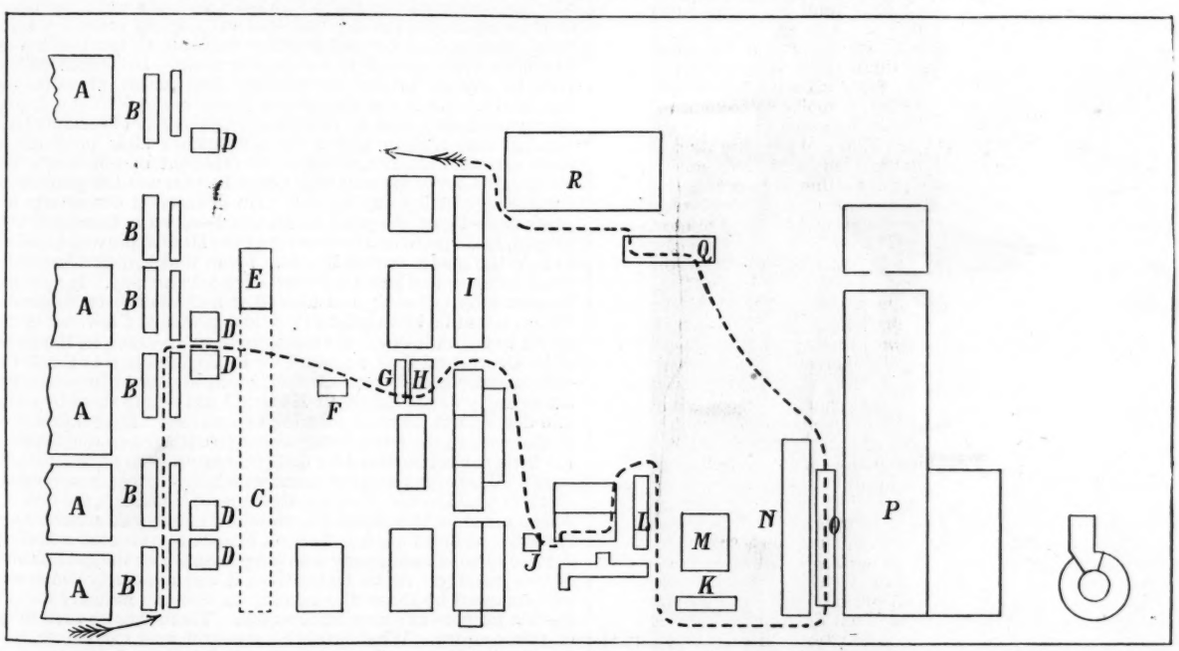
The departure of the guests from Beckton was one which has impressed itself on their minds. The workmen on this exceptional day were allowed a little more freedom than usual, and from points of vantage on the decks of the piers, numbers watched the leaving of their visitors. When all had embarked, the Band again played the National Anthems, during which visitors and English alike uncovered, but between the anthems lusty cheers rent the stillness, in which the Beckton workmen gave evidence of their strength of lung. With the playing of "Auld Lang Syne," the cheering of workmen, and the piercing shrieks of syrens, which were responded to from the boat, the passage across the river to the East Greenwich works commenced. Tea was then served on board.

[The photograph we reproduce of Beckton from the river, p. 266, is one of two taken by Mr. Goulden's assistant (Mr. J. N. Reeson); and copies have very kindly been presented to the visitors as souvenirs of the occasion. As points of interest, it may be stated here that the area of the Beckton works is 263 acres; the number of 10-feet retorts 8404; the productive power (winter, 1901) 61 million cubic feet per day, 10 millions being carburetted water gas. The number of workmen employed in winter is 6000.]

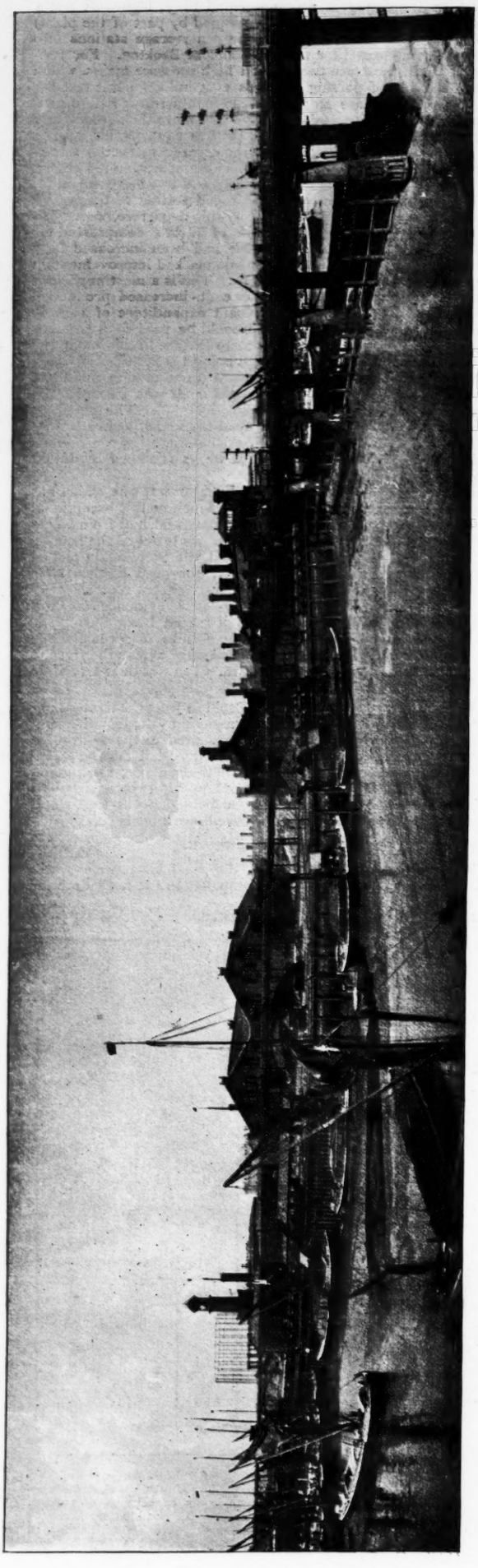
At East Greenwich.

When approaching the pier of the East Greenwich works of the South Metropolitan Gas Company, the visitors descried

Plan of the Products Works of the Gaslight and Coke Company at Beckton.



A. Five Pitch Stores (30,000 tons). B. Boilers (48) for the Distillation of Tar, capacity about 2500 gallons in 16 Hours. C. Eight Underground Tar-Tanks, capacity 2,500,000 gallons. D. Tanks (32) for Distilled Oil, capacity 317,000 gallons. E. Anthracene Cooling Tanks. F. Naphtha-Distilling Boilers. G. Eight Benzol Washers. H. Buildings used for the Distillation of Benzol. I. Benzol Stores, capacity 56,000 gallons. J. Naphthalene Candle Factory, capacity 20 tons per Month. K. Buildings for Crushing and Bagging Naphthalene. L. Naphthalene Distilling Apparatus, capacity 200 Tons per Month. M. Apparatus for the Distillation of Carbolic Acid, capacity 30 Tons per Month. N. Steam-Boilers (41). O. Eight Distillation Boilers and Four Saturators, capacity 25 Tons of 25 per Cent. Ammonia per Day each. P. Sulphuric Acid Factory, capacity 100 Tons per Day. Q. Canteen and Volunteer Exercise Ground. R. Barrel-Filling House.



Beckton from the River.

Mr. C. C. Carpenter (Chief Engineer of the Company), Mr. Frank Bush (Secretary), Mr. J. Tysoe (Engineer of station), Mr. A. F. Browne (Vauxhall), and other gentlemen—including Mr. T. H. Goodwin Newton, the Chairman of the Imperial Continental Gas Association, Mr. Walter Hunter, and Mr. R. S. Gardiner—waiting to receive them. Owing to the length of time which had been required at Beckton, only a hasty survey of the plant could be made. It was seen that there is a good deal of new work in hand at the station. As many readers may be aware, there are at present four retort-houses, each capable of producing 5½ million cubic feet per day; and all are provided with simple generator furnaces, two to each through setting. Five-sixths of the retorts are worked by stoking machinery, both West and Arrol-Foulis. The foundations of the fifth retort-house are being got out at the present time; and automatic coal-weighing machines are being introduced into the house to record the weight of coal carbonized. It was heard with interest that not only is the liquor produced here converted into sulphate of ammonia, but all that is produced at Vauxhall is brought down by barge to be similarly dealt with. All the sulphuric acid required is made on the premises. New sulphate works are being laid out, which, when completed, will have a capacity of 150 tons per day. New acid works are also in course of construction, to produce all the sulphuric acid needed. Perhaps the 12 million cubic feet holder was the object of supreme interest; and the single word "*magnifique*" which passed the lips of one of the visitors no doubt described the impression of them all. A very close examination was made of the four Sturtevant fans which are fixed at the outlet of the holders, and each of which has a capacity of about a million cubic feet per hour, for sending gas to the other stations and for supplying pressure to the district when the holders are too low to give the necessary pressure. These fans are driven by Crossley gas-engines at speeds varying from 1300 to 1900 revolutions per minute. Every attention and politeness were shown by Mr. Carpenter, Mr. Tysoe, and the other officials; but they lamented that the time at their disposal did not permit of a more thorough inspection.

The visitors then left by boat for the famous Ship Hotel at Greenwich, where they were to be the guests of the three Companies during the evening.

The Dinner.

The dinner was a brilliant success, but it was a matter for regret that Mr. George Livesey was unable to be among his foreign colleagues, who would have been happy to see in person one about whom they have heard and read much. During the day, his work in the engineering branch of the gas industry was the subject of frequent conversation, and particularly when the visitors were faced by some of the monumental evidences of it at East Greenwich. The Governor of the Gaslight and Coke Company (Colonel W. T. Makins) presided; and his amiability, and the graceful manner in which he discharged his duties, won for him the regard of the guests from abroad. Mr. H. E. Jones was the principal vice-chairman and he likewise captured, by his courteous attention to all about him, their friendship and esteem.

The loyal toasts of both nations having been drunk, and "God Save the King" and the Marseillaise sung, Colonel Makins proposed the toast of the Société Technique. To those members who had honoured the three London Gas Companies by being their guests during the day and that evening, he offered a most hearty welcome, and a still heartier welcome to the ladies who had been good enough to accompany them. He would endeavour to say as briefly as possible how much pleasure the Société had given the Companies by coming to England, and seeing what they had to show them in the way of technical gas making, and also in giving the Companies their presence at their various little hospitalities. He thought that it would not be disputed for a moment that Great Britain was the pioneer in the industry of lighting by gas. He believed it was nearly 100 years ago—84 or 85 years to be exact—since a Company was formed, and sanctioned by charter in the Municipality of London, to light the public streets by gas. From that had developed the great industry in which they were engaged that day. It speedily became international; and abroad it had since been improved by the scientific knowledge of gentlemen who had devoted themselves to the industry. He mentioned, as an example, the name of M. Drory, and then said that we in England had to thank the various nations of Europe for their great assistance in promoting the industry of gas lighting. He would not detain them by going into details, but he must mention two names. First was that of M. Coze, who he believed was a compatriot of their own, and to whom gas makers were indebted for that great improvement, the inclined retort. There was another name which had become as familiar as a household word. That was the name of Welsbach, the effect of whose scientific knowledge they now saw in every street and shop. He believed that their friends from France represented a Society the like of which unhappily was not possessed by the gas industry of this country. As he understood, it was a Society which was well endowed by those who carried on the gas industry for the specific purpose of scientific research. There was no such thing in this country. What scientific research was carried on, was done at the Universities and by the Polytechnic Institutes; but there was no body set apart and endowed for the special purpose. In this particular, they envied the French gas industry in possessing the Société Technique. England and France had in years past marched, and would go on marching together, promoting everything that was beautiful in the way of Art, and everything

which was beautiful in the way of Science. He was perfectly certain of this one fact—that to the industry of gas lighting both these and all other nations were indebted for the very great advance in the progress of civilization. There was no greater civilizer, there was no greater educator, than light; and he thought they were entitled to all credit for being purveyors of light to the world. Changes were continually taking place; but so long as they set before themselves the one object and aim of carrying on the industry in the most scientific, most economical, and most efficient way they could, he was perfectly certain they would deserve well of the world.

On behalf of the South Metropolitan Company, Captain Heathorn added a few remarks, in the course of which, amid applause, he said that those who worked together in light worked together for peace and happiness, and such were the lights of the world. Electricity was another competing power working on the same lines; but it was certainly not the poor man's friend—it was only for the rich.

In his reply, M. Cornuault expressed his regret that neither the President nor Vice-President of the Société had been able to take part in the visit. The splendid reception which had been given them that day by the three London Companies had exceeded all that they could possibly have expected; and he and his fellow members were much struck by it. As to their visit to Beckton, they had not ceased to admire the enormous installations there, the model works for the distillation of tar and the manufacture of multitudinous bye-products, and the water-gas plant, which all testified in a high degree to the care bestowed upon their work by their English colleagues and especially by the Resident Engineer of the works, Mr. Goulden. Crossing the Thames they had seen the large works of the South Metropolitan Company, which were built some fifteen years ago by Mr. George Livesey, whose reputation as an Engineer and as a Director had spread all over Europe. In their short visit to the East Greenwich works, they seemed to see indications of the master mind which had directed the entire undertaking. Another point which they admired was the method of conducting the gas business which associated the interests of shareholders and consumers. He envied the English gas companies in this, and more particularly in the perpetuity of their concessions. He drank to their colleagues of the Metropolitan Companies, who had received them in such a splendid manner.

On the part of the three Companies whom he had the honour for the moment to represent, Colonel Makins thanked M. Cornuault and his colleagues for their compliment. He then called upon Mr. H. E. Jones to propose the toast of "The Ladies," which that gentleman did in a very gallant manner. Response was made on behalf of the ladies by M. Mallet; and a few happy words of thanks to the hosts by M. Visinet concluded a day the recalling of which to mind will always give pleasure to those who were participants.

The Institute and Institution Amalgamate in Welcoming the Visitors.

A large part of Wednesday was devoted by our visitors to sight-seeing in London; but the principal function of the day was a luncheon at the Hotel Cecil, to which invitations were issued jointly by the Incorporated Gas Institute and the Institution of Gas Engineers. The visitors numbered about 90; and the representation of the two organizations (mostly members of the Councils) was about 40. Mr. Corbet Woodall received the company in an ante-room to the Victoria Dining Hall, and subsequently presided—Mr. S. W. Durkin, the President of the Gas Institute, and Mr. J. W. Helps occupying the vice-chairs. The *déjeuner* was worthy of the occasion; and the Chairman directed the proceedings with that amiability and courteous touch which produced intense satisfaction both to hosts and visitors. The speeches, too, were peculiarly suited to the occasion; and the subject of unity intersected them with noticeable frequency. The two first toasts were the King and the President of the French Republic.

Then Mr. Thomas Newbigging, whose name was recognized by the visitors as that of a chief among English engineers, proposed the toast of the Société Technique de l'Industrie du Gaz en France. In his remarks, he said that, when the Secretaries of the Institute and the Institution requested him to undertake the honourable duty of proposing this toast, they were probably not aware that he (Mr. Newbigging) was a member of that distinguished body the Société Technique; indeed, when he consented, as he most willingly did, to undertake the duty, he had for the moment overlooked the fact himself. If he had thought of it, he might perhaps have hesitated to do what looked, on the first blush, like asking them to toast "our noble selves." However, it would be false delicacy for him to take that view of the matter. So far as he was concerned, he put aside for the moment the fact of his honorary membership of the Société Technique—a distinction which he highly appreciated—and spoke as a member of the great body of English gas engineers when he said that it gave them unfeigned pleasure to welcome their friends across the Channel to accept their hospitality and sincere good wishes for their professional and personal health and welfare. Meetings of this pleasant kind between members of the same profession in different countries admitted of the exchange of those warm fraternal greetings which were calculated to promote national good feeling and to soften the asperities that sometimes arose from differing political views. In England, they had a saying that "trade follows the flag." He was doubtful of its truthfulness. He believed that it was originally a French saying. It was one of those brilliant sentences—those perfect jewels in words—which *la langue française* provided in wonderful abundance. But he preferred another axiom which he thought contained more truthfulness than the one he had just quoted; in fact he had no doubt whatever of the truth of it. It was that "mutual respect follows the generous rivalry of professional workers in all countries to excel in matters of science and art." In the world of gas enterprise, the Société Technique held a distinguished place. He need scarcely tell them that British gas engineers scanned the Société's "Transactions" with the greatest interest; and they endeavoured to profit, and did actually profit, by what they found in them, and they were proud and pleased to bear witness to the progress of the gas enterprise in the great country of France. He had sometimes heard it remarked that French engineers excelled in the theoretical rather than in the practical work of their profession. If this were so (he did not mean to imply that, in his opinion, their practice was one whit behind that of England), then he thought it paid their French colleagues a high compliment. In his view, the best practice was based on a wise substratum of theory. To theorize was to think; and where there was an absence of thinking on the part of an engineer, his engineering practice was very apt to be of a humdrum sort. They could depend upon it, that there could not be any real sound and solid practice (certainly not original practice) unless it was preceded by theory—in other words, by thinking. But on this question of practice, he would point to the proceedings of the Société's present meeting. So far as reported, he was struck with their thoroughly practical character. It would be invidious of him to name special papers that had so impressed him; but he strongly recommended them to British gas engineers, feeling assured that their perusal would afford them matter of the utmost practical value. At the same time, he ventured to express the hope that their friends of La Belle France sometimes met with something that they could peruse with advantage in the "Transactions" of the English Societies. Concluding his speech (which was very cordially approved), he asked his colleagues to do honour to the toast which he most heartily proposed.

The toast was cordially honoured; and in his response, M. Cornuault said the last day of the congress had arrived. It had passed so quickly in the midst of their amiable colleagues that he dare hardly believe their labours had ended. By a delicate attention, it had been the wish to close the evening of these magnificent receptions by a fraternal reunion of the English and French Societies. He drank to this fraternal union, and to the union of gas men English and French, especially of the two societies—the Incorporated Gas Institute and Institution of Gas Engineers.

The sentiments to which M. Cornuault gave expression were warmly acquiesced in by his confrères.

Responses were made by Mr. S. W. Durkin as President of the Institute and by Mr. J. W. Helps as Past-President of the Institution. Mr. Durkin remarked that he had to acknowledge the very hearty way in which the toast had been proposed by M. Cornuault and responded to by the members of the Société Technique. He was pleased to have had the opportunity of meeting so many of his Continental confrères. He had never been on the Continent; and he could only say, on behalf of the Institute, how pleased they were to see their many friends from France. Apology was first made by Mr. Helps for the absence of the President of the Institution (Mr. W. R. Herring). It was quite impossible for him to be in London that day; and, in writing a few days since, he asked him (Mr. Helps) to express his regret, and to say how pleased he would have been to have been present to welcome his French friends. In replying to the toast, he had some little advantage over the President of the Gas Institute, inasmuch as in September last year he was able to go to Paris, and accept the hospitality of the Société Technique. The splendid way in which the English engineers were received on that occasion would always be a pleasant recollection. It had given the Institution of Gas Engineers the greatest pleasure to join with their friends of the Gas Institute in offering their visitors some small hospitality that day. This meeting savoured somewhat of an international union (it was also, if he might be allowed to use the expression, an inter-institutional gathering); and he trusted that this event which brought them together in a threefold way would not only assist in cementing the gas industry at large—that was to say, the French and English industry—but would have the good and lasting effect of assisting to cement the industry in England.

A deservedly graceful acknowledgment was made by M. Cornuault of the part Mr. R. S. Gardiner had taken in organizing the visit. In his reply, Mr. Gardiner declared that M. Cornuault had attributed to him an exceptional amount of work in the organization, and he disowned his right to the thanks which had been accorded to him. There was, however, among them that day, a man who was known on both sides of the Channel, without whom no international meeting of gas men would be complete, and who was a Past-President of both the Institute and Institution. He referred to Mr. Corbet Woodall. It was upon him that the labour of organizing the entertainments and visits had to a very large extent devolved.

With their characteristic enthusiasm, the visitors pledged the health of Mr. Woodall. In his acknowledgment, Mr. Woodall said it had been an unqualified pleasure to have had anything to do with the reception which had been accorded to their friends of the Société Technique; but he wished to say to M. Cornuault and the

rest of their friends that the members of the British gas engineering profession had no desire whatever to diminish at all their sense of obligation for the courtesies and gracious kindnesses they had had shown to them whenever they had been visitors in France. At the same time, it had been a great satisfaction to be able to show in some small way that the recollection of these courtesies was keen and strong within them, and would endure. The gas engineers of England liked sometimes to be hosts as well as guests. For his own part, he wished to say that the recollection of the year 1878, when he first of all had the pleasure of meeting the Société Technique, would never vanish from his mind. He looked back upon that occasion—the year when M. Servier was President of the Société Technique—with feelings, and undiminished feelings, of gratitude. He very much wished these meetings of Frenchmen and Englishmen were more frequent. He believed the kindly feeling which always characterized their personal meetings might probably be extended so as to make the greater the cordiality between England and France. "That may God bring speedily." He thought the episodes of the three days' visit had been extremely interesting and striking. On Monday night they were the guests of three great Companies doing business on the Continent, who joined together in order to give a welcome to their visitors. On Tuesday, they were the guests of three Gas Companies of London, who were usually supposed, to use a vulgarism, to "paddle their own canoes" and to go their own ways; but, on this particular occasion, they came together delighted to have an opportunity of saying welcome to their friends from France. As Mr. Helps had said, that day they were the guests of two societies unfortunately temporarily divided one from another, but who found in this visit a bond of union which drew them together and made them one—thoroughly one—for the day. Mr. Woodall's concluding words were: "Gentlemen, we have been rivals in many fields with varying issues; but I trust, and we all trust, our rivalry in the future will only be in the direction of advancing those efforts of science and commerce which tend to the union, the advancement, and the comfort of the nations of whom we form a part."

The services of M. Visinet, the Secretary of the Société's Excursion Committee, were also acknowledged; and we may here conveniently mention the names of Mr. W. T. Dunn, the Secretary of the Institute, and of Mr. T. Cole, the Secretary of the Institution, in connection with the interest which they took in promoting the success of this particular function.

Before the unique gathering separated, a photographic record was secured.

Au Revoir.

The afternoon (which fortunately was fine compared with the miserably wet morning) was spent by a few of the visitors at the House of Commons, and by many in inspecting certain other of our public institutions and buildings. The departure for home was made from Victoria Station just before nine o'clock. Before leaving, M. Cornuault personally expressed the great pleasure which he and his comrades had derived from their brief sojourn in England. *Au revoir.*

OUTPUT AND CONSUMPTION OF COAL IN THE PRINCIPAL COUNTRIES OF THE WORLD.

The Board of Trade have recently issued a return containing many interesting statistics relating to the production, consumption, and export of coal in the principal countries of the world in each year from 1883 to 1899, with provisional figures for 1900 in the case of the most important of those countries. In view of the very special prominence recently given to the coal question by the course of events, and of the probability of the question continuing in the near future to be a subject of discussion, the following particulars, taken from the Board of Trade tables, will be of interest to many of our readers. One of the most striking facts noted in considering the figures contained in these tables, is the very material increase in the quantity of coal mined in the chief producing countries during the very period when coal was everywhere so "scarce" as—by its increase in value—to cause serious injury to trade. The following figures give the output of the five principal countries for the past three years:—

Country.	(Thousands of Tons.) 1898.	1899.	1900.
United Kingdom . . .	202,055	220,095	225,181
United States	196,406	226,554	245,422
Germany	96,310	101,640	109,225
France	31,826	32,256	32,587
Belgium	22,088	22,072	23,352
Total .	548,685	602,617	635,767

The coal "famine" that began in the autumn of 1899 arose, then, in the latter part of a year in which the output of the four chief coal producing countries of Europe (including the British Islands) was 24 million tons, and that of the United States 30 million tons, greater than before; and continued the greater part of a year in which the European output increased by a further 14 million tons, and that of America another 19 millions—a truly remarkable fact.

The total output of coal throughout the world in 1900 cannot have fallen far short of 700 million tons. With production so rapidly expanding, the surprising thing is, not that the price of coal has so speedily returned to its normal level, but that it should have been maintained so long at the high prices at one time obtained. Had it not been for the extraordinarily active state of trade in the United States, which enabled the market there to absorb practically the whole of the enormous increase in coal output of 49 million tons in two years, prices would probably have broken earlier, as, at their highest level, they afforded a splendid opportunity for the American exporter. As it is, we must be thankful that things were not worse, as they might have been had the demand for coal in the United States so outstripped the supply as to have made it more profitable for producers there to have sold for home consumption the 7½ million tons they exported, to the no small relief of our market.

That the collieries in the States were able so easily to keep pace with the demand was due, it should be noted, to the rapidly growing use of coal-cutting machinery, as to which particulars have recently been given in the "Journal." So well did supply meet demand, that coal prices rose very little in the States, remaining well below the normal level of value in this country. The average pit-mouth values of coal in the United Kingdom and in the United States now and ten years ago afford an instructive comparison:—

	United Kingdom.	United States.
1888	5s. 0¼d. per ton	6s. 0d. per ton
1889	6 4½ ,,	5 3½ ,,
1890	8 3 ,,	5 2¾ ,,
1898	6 4½ ,,	4 5 ,,
1899	7 7 ,,	4 8½ ,,
1900	10 9¾ ,,	5 5½ ,,

It will be seen from the preceding figures that the cost of production in America has been so reduced within the past decade, by the adoption of labour-saving machinery, that the coal can be sold there at the pit-mouth at fully 2s. per ton less than it can in this country in normal times. Last year the difference was over 5s. per ton.

The total annual output in the British colonies and possessions amounts to about 17½ million tons, of which India furnishes 5, New South Wales 5½, and Canada 4¾ millions. The average value realized at the pit-mouth was, in India (1899) 4s. 2¼d., in New South Wales (1900) 6s. 1d., and in Canada (1900) 10s. 11d. This country, being by far the greatest exporter of coal, naturally shows a much wider difference from the United States in regard to its aggregate consumption than in regard to its output of coal. In 1900,

The United States produced	245·4, consumed	239·6 million tons.
The United Kingdom ,,	225·2 ,,	166·8 ,,
Germany . . . . . ,,	109·2 ,,	99·2 ,,
France . . . . . ,,	32·6 ,,	46·0 ,,

In *per capitâ* consumption of coal, however, this country stands pre-eminent and unapproached. Taking the 1899 figures, we consumed 4·05 tons per head of the population, as compared with the United States, 3 tons; Belgium, 2·83 tons; Germany, 1·66 tons; France, 1·10 tons; Austria-Hungary, 0·39 ton; and Russia, 0·12 ton. In France, the *per capitâ* consumption at first sight appears very small for a country so far advanced; but this is in a great measure accounted for by the large quantity of fuel of other sorts—such as turf, wood, and lignite—which are used in that country. In Germany, a large and increasing use is being made of denatured spirits for purposes for which coal is used in other countries. As showing the extent to which some countries are dependent upon foreign (especially British) coal for their requirements, a table giving the percentages of native coal, of British coal, and of coal imported from other countries, used by the principal countries, is of considerable interest. British coal forms 90 per cent. of that used in Sweden, 89 per cent. of that used in Italy, 33 per cent. in Spain, 16 per cent. in France, and 13 per cent. in Russia. We supply from our own mines practically the whole of our requirements, while the United States obtain 99⅓ per cent. of theirs, and Germany 92 per cent., from native sources.

A statement is given in the Appendix to these tables showing the total quantity of coal brought to London by railway, canal, and sea (coastwise) for the years 1898-1900. This statement shows that the quantity of coal brought into the area within a radius of 15 miles from Charing Cross in 1900 was 15,745,658 tons, compared with 14,577,943 tons in 1899 and 14,305,076 tons in 1898. The increase last year is very remarkable. Somewhere about one-third of the total quantity brought to London would be used for gas-making purposes. More than half of the total is brought by sea, and nearly the whole of the remainder by rail; the amount brought by canal being quite insignificant—viz., only 15,484 tons in 1900.

At the end of the coal tables, are given statistics of petroleum production and trade in Russia and the United States for a series of years. In 1899, the total production in the United States was 1997 million gallons, as compared with 1603 millions in 1890, and 920 millions in 1880. For Russia, the figures available for the most recent years relate to the Baku district only. The production in this district was 2206 million gallons in 1899, and 2521 millions in 1900. About 80 per cent. of the Russian output, and 55 per cent. of the production in the United States, are consumed at home; but the average consumption per head of the population is greater in the latter country.

THE RESPONSIBILITY OF TRADE UNIONS UNDER THE LAW.

THE judgment of the House of Lords in the celebrated case of the Taff Vale Railway Company against the Amalgamated Society of Railway Servants and others, which was delivered on Monday of last week, is by far the most momentous deliverance of a Court of Law that has yet touched on the status of Trade Unions in the United Kingdom. The importance of the judgment has been recognized on all sides; and it is not too much to say that it must have already spread dismay throughout the ranks of professional Trade Unionists. For the House of Lords have unanimously adopted the broad principle of law laid down by Mr. Justice Farwell, that Trade Unions can be sued in their registered names, and be held responsible for the acts of their officials. The facts of the case which educed this eminently common-sense judgment are typical of the kind of thing that has gone on for too long a period. The Taff Vale Railway Company, about this time last year, had a dispute with some of their servants, in which the Amalgamated Society of Railway Servants interfered by the agency of their Local Organizer, James Holmes, and their General Manager, Richard Bell. The Taff Vale men struck; and the Society and the officials supported them in their action. Mr. Bell communicated with the Company, stating that all negotiations with the men were to be conducted through him; and the railway was then beset. A handbill was issued, signed Richard Bell, proclaiming that all men who accepted employment on the line would be blacklegs. On Aug. 23 last, the Company began an action for an injunction to stop these proceedings; and on Aug. 30 two applications were made to Mr. Justice Farwell—one for an injunction against Bell and Holmes and the Society; and the other, on behalf of the defendants, that the name of the Society should be struck out of the action. On Sept. 5, Mr. Justice Farwell granted an injunction on the summons against the respondent Society, and at the same time dismissed with costs the application to strike the name of the Society out of the action. The learned Judge gave as his reason for so deciding that he could not accept the contention that these bodies, existing under statutory sanction—capable of owning great wealth and of acting by agents—were not to be held responsible for the wrongs they might do to other people by the use of this wealth and the employment of these agents.

The Society appealed against this decision to the Court of Appeal; and on Nov. 21 the Court, composed of the Master of the Rolls and Lords Justices Collins and Stirling, reversed it, and dissolved the injunction granted by him against the respondent Society, and ordered the name of the Society to be struck out of the action. It must be allowed that this ruling was more in accordance with what had come to be the recognized status of Trade Unions than Mr. Justice Farwell's judgment. Notoriously, Trade Unions were not corporations, with the right to sue and be sued in their own names. They had names; but their property, such as it might be, was held by trustees, who consequently had to sue or be sued in respect of it by themselves. Previous to this case, it was generally regarded as useless to bring an action against a Trade Union by name; and those who acted for it could only be proceeded against in their private capacity. This meant that while a Trade Union official was able to exercise all the power of the Society, and use its funds to the last farthing, the moment the law was set in action against him, he became a "man of straw." The Court of Appeal, construing the Trade Union Acts of 1871 and 1875 after the strict letter, found that not being corporations, power to sue and to be sued in their registered names must be conferred upon these organizations, and that the language of the statutes is not sufficient for this purpose.

We discussed the finding of the Court of Appeal on Nov. 27, remarking that, if it was good law, the community were face to face with a divorcement of responsibilities from rights in the case of Trade Unions that had no parallel in other social relationships. Of course, such a consideration as this could not weigh with the Judges of the Appeal Court, who only had to read the Act according to their legal lights. We mentioned at the time that the fact of the Labour Commission having reported in favour of making Trade Unions amenable to the law in this way, might be regarded as fair presumptive evidence that such liability did not exist; thus supporting the view of the Appeal Court. All this tissue of presumption and narrow legal interpretation of the consequence of the omission from the Acts of specific words conferring liability has now been swept away, and Mr. Justice Farwell is upheld by the House of Lords as having known the law. Thus the ultimate tribunal of the country has declared the doctrine preposterous that any body of persons—a "thing," the Lord Chancellor called it—cannot be made accountable to justice for wrongs committed by its authority and procurement.

The Lord Chancellor was content to adopt the judgment of Mr. Justice Farwell, and saw no necessity for basing his opinion on any other reasoning. Lord Macnaghten, however, went further into the case, which he characterized as divisible into two questions—one of substance, the other of form. Is a Trade Union sueable or not? If so, how? Trade Unions may be registered or not; but in either case they are legal bodies. They have a common fund, which is applicable to all the purposes of the society, including the support of strikes and incidentals thereto. The substantial question therefore is whether the Legislature has authorized the creation of numerous bodies of men, capable of owning great wealth and of acting by agents, with absolutely no responsibility for the wrongs they may do to other persons by the use of that wealth and the employment of those agents? In Lord Macnaghten's opinion, the Legislature has done nothing of the kind. He finds reason to believe that Parliament, in legalizing Trade Unions, had no intention of relieving anybody from liability for the result of any action or default—singly, or in concert with others. For this purpose, it appears to Lord Macnaghten that it cannot matter in the least whether persons acting in concert are combined together as a Trade Union or are in any other form of association. They can never, to his Lordship's mind, rise above the law.

If, then, these particular societies are as substantially answerable for their acts as any individual subject of the realm, the only remaining question worth considering is how they should be sued. Lord Macnaghten has no doubt whatever that a Trade Union, whether registered or not, may be sued in a representative action if the persons selected as defendants are persons who, from their position, may be taken fairly to represent the body. This was not the case in *Temperton v. Russell*, where the defendants were selected in defiance of all rule and principle. They were not the Managers of the Union, and had no control over it. This mistake must not occur again. Lord Macnaghten refuses to think the law so powerless that it cannot reach a Trade Union, either through representatives or directly in its own name. The registered name is nothing more than a collective name for all the members; the registered office is the place where it carries on business. Lord Macnaghten cannot see anything contrary to principle or contrary to the provisions of the Trade Union Acts in holding that a Trade Union may be sued by its registered name.

Lord Lindley observed that the problem of how to adapt legal proceedings to unincorporated societies is by no means new. The rules as to parties to common law actions are too rigid for practical purposes when they have to be applied to such societies. The rules as to parties to suits in equity are not so rigid, and are intentionally adapted to avoid failures of justice. There is no difficulty in suing a Trade Union in its registered name, through its executive members, and by its trustees. Lord Lindley entirely repudiated the notion that the effect of the Act of 1871 is to legalize Trade Unions and confer on them rights to acquire and hold property, and at the same time to protect the Union from legal proceedings if the managers or agents acting for the whole body violate the rights of other people. On the point of procedure, since every Trade Union has a name, Lord Lindley remarks that he can see no reason whatever why the registered name should not be used in legal proceedings which may be taken for and against the body. If it is a matter of money, the trustees ought to be joined in the action. Unregistered Unions can be sued by their responsible officers.

The judgment of the Court of Appeal was accordingly reversed, and that of Mr. Justice Farwell restored, with costs in both Courts against the respondents. The effect of the judgment will be far-reaching and enormously important. No longer will Trade Union officials be able to bulk both large and small at the same time, in carrying on their military operations. For whatever they may do, the funds of the Union can be made to pay to the last farthing. It is not at all necessary to wait for information as to how professional Trade Union leaders are likely to regard this new condition of affairs. The principle of Society liability for the actions of officials was strongly condemned by the Labour representatives on the Royal Commission, on the ground of the injustice of making the accumulated funds responsible for the vagaries of small and often ignorant men. So long as it was only employers and their money who were at the mercy of such men, the Trade Unions did not mind; when it became a question of allowing them to imperil the Union funds, however, objections were raised. Nor can it be truly said that these objections are unreasonable. This or that loud-mouthed "comrade" may be an excellent "organizer," or walking delegate; but he is not always to be trusted with the cash-box. It is only fair, however, that the Unions should be made to experience all the responsibilities they incur by employing such men.

There is nothing to be added to the House of Lords judgment, which will probably be furiously assailed by the usual Trade Union agitators. This will not matter, so long as it remains in force. If any labour members in the House of Commons should attempt to override it by a Bill for explicitly setting Trade Unions above the law, this task will be found a very different undertaking from merely taking an unfair advantage of a faultily constructed Act. After the first uproar has died away, in all probability the new statement of the law, by the greater responsibility it places upon the shoulders of Trade Union officials, will tend to the improvement of this class of professionals. When it is thoroughly understood that the action of a small Branch Secretary may imperil all the accumulated funds of a society, his freedom of action will be considerably diminished; while for the higher executive offices prudent men, not firebrands, will be selected. Otherwise, the fate of the Unions will be easy to foretell. They often suffer, as it is, at the hands of rash or unprincipled officials; but as the law now stands, these may easily ruin them. Meanwhile, in any case, it is difficult to see how the customary intimidating strike practices can be carried out, since the Union can be sued for damages at once, and an injunction applied for at a few hours' notice. All this makes for industrial peace, and is therefore something to be thankful for.

ELECTRIC LIGHTING MEMORANDA.

The Fortunes of the City of London Company—The "Journal" Supported by an Electrical Contemporary—Why Electric Traction Grows—Why Electric Lighting Does Not Prosper.

THE meaning of competition in electric lighting is written all over the accounts of the City of London Electric Lighting Company, which are analyzed in the current number of the "Electrician." The net result of the past year's trading was a profit balance on revenue account of £57,328, or 3·51 per cent. on the mean capital outlay of £1,756,431. Not a very paying concern this, though serving the Commercial Metropolis of the world! Yet the business continues to grow, and the load-factor at 12·7 per cent. must be considered good for such a peculiar district, with so little night consumption of current. The mischief lies in the high percentage of total cost to gross revenue, which now stands at 73·1 per cent. There is no dividend; and the sum set aside for depreciation is only £1514. There is still in existence a considerable depreciation fund, including the old reserve, formed out of premiums; and this is now made to bear the cost of the repairs and renewals. If the fortunes of the undertaking do not take a favourable turn before this resource is exhausted, the situation will be awkward. It is a very impressive thing that the Company which came into the world with such difficulty, after so protracted a period of incubation, should have already got into such a questionable condition. It is so big a concern, too, with a year's output of nearly 12½ million units. The total revenue works out to only 4·109d. per unit sold, notwithstanding the adoption by the Board of the Brighton system of charging, starting with 8d. per unit. In the circumstances, the remedy indicated would appear to be municipalization. We quite expect some perfervid advocate of this principle to get up in the Court of Common Council and move that the Corporation do acquire the undertaking of the Company. It will interest gas engineering readers to learn that the number of public arc lamps supplied by the Company decreased by 40 during the year.

It is gratifying to us to find our expressed views respecting the prospects of such diverse enterprises as Mond gas distribution and suburban electric tramways and railways substantially supported by the "Electrician." When two such differently inspired critics of contemporaneous affairs agree, the presumption is that there is a pretty solid substratum of common sense at the bottom of their concord. Our contemporary calls the idea of long distance power transmission by means of Mond gas an "enchanting dream," from which there is certain to be a rude awakening. While subscribing to the general opinion as to the promising character of Mond gas for independent use in power generation, the "Electrician" scouts the notion that it will ever supplant high-pressure electric cables for the distribution of power wholesale far and wide. "We never expect to see it pay, and hardly expect to see it seriously attempted more than once." This is explicit enough. With regard to our remarks in this column last week on the influence of trolley tramways on suburban railway traffic, it is observed that these are decidedly pertinent, notwithstanding that the "JOURNAL" is far from being normally prejudiced in favour of electric traction.

This latter qualification does us some slight injustice. Our views with respect to the application of electric power to various forms of land transport have been freely recorded these many years, and have not been biassed in regard to the principle, one way or the other. It is very long ago now since we expressed the opinion that it would be in the department of traction, rather than that of lighting, that electrical engineers would find the largest and most profitable field for their energies. Our reason for conceiving this judgment was, and is, regard for the facts that the use of power for traction purposes is far and away larger than anything that can ever be wanted for artificial lighting; and that whereas electric traction is demonstrably both cheaper and better than either horse or steam on rails, electric lighting is an expensive luxury. There is no room for prejudice in reasoning from these premisses. Either they are right, or they are wrong. If they are right—and we do not imagine that anyone with competent knowledge will now dispute them—then the conclusion follows naturally. Electrical engineering nowadays is no longer a matter of a semi-portable engine and a few score of lights for the rising town of New Bunkham; but it deals with power mechanism on a scale that the older order of consulting electricians are incapable of touching. Also, in important municipalities where lighting and tramway traction are combined, the former has already sunk into insignificance compared with the latter.

One more point of the "Electrician's" commentary upon our remarks calls for notice. It is observed by our contemporary that incidentally we reflected on the experience of the advent of electric lighting by the gas companies fifteen years ago, and the reminder is characterized as offering "poor consolation to the doomed railway companies." If fifteen years hence, the railway companies generally occupy the same relative position to the electric trams and tubes of the period as the gas companies actually hold in regard to electric lighting, they will have no cause of complaint. We hinted as much in the beginning of our remarks on the subject, in admitting the difference between the circumstances of the two interests. With but one notable exception, electric light has nowhere been able to take up the increase of gas companies' business. On the contrary, as Mr. J. S. Raworth—not a prejudiced witness for gas—has confessed before his fellow technicians, the bare increase of gas consumption for the period under notice is more than the whole bulk of the electric light supply of the country. Electricians will do themselves no good by feigning to ignore such salient facts as this. They cannot have it both ways. If electric trams and tubes increase and prosper because they offer a cheaper and better public service than any other, electric lighting must remain a small and select service, because it is dearer and not so serviceable as gas. This is the long and the short of it. We have the best of goodwill towards electric railways and trams—provided they do no injury to other things equally entitled to exist—and shall continue to try and interest our readers in them out of respect for the great part they are evidently called upon to play in the redistribution of urban populations, which is a subject that the gas industry cannot afford to neglect.

THE PRICE OF OIL AND THE PROSPECTS OF ENGLISH GAS MANUFACTURE.

IF in the days of the wise King of Israel it was open to a sagacious observer to complain of the plague of book-making, what should be said at the present time of the graver pestilence of periodical publications, which are as the locusts of Egypt for multitude and voracity? The reference is for the moment to the absurd multiplication of specialized journals, which has long surpassed the reasonable requirements of the working world and the assimilative powers of interested individuals. The instant a new branch of industry is started, two or three special journals appear in its name and attach themselves to its fortunes. This feverish journalistic enterprise would not be open to so much question, if only the contemporary and often ephemeral literature so readily produced were generally well done. But, unfortunately, this is rarely the case. People already engaged in the commercial side of journalism undertake to bring out a paper writing up auto-cars, or acetylene lighting, or municipal trading, or some other "movement" of the hour; and to say of those who are employed to do the writing that they are not exactly experts in the line is putting it very mildly indeed. By the assiduous practice of what is called "log rolling," these periodicals keep one another in countenance, and occasionally succeed in obtaining a free advertisement in a friendly newspaper.

The utter lack of trained judgment on the part of the editorial staff of a self-styled technical journal of this class causes great reliance to be placed upon the attraction, for instructed readers, of the signed article and the "interview." But an occasional good article cannot make the periodical in which these contributions appear a trustworthy authority on the subject which it pretends to have made its own, journalistically; neither does every expert on a particular subject necessarily make a satisfactory technical journalist. These reflections are suggested by the fashion in which the great industry of petroleum is served by the special journal, edited by Dr. Paul Dvorkovitz, which calls itself "The Petroleum Industrial and Technical Review." It is unnecessary to introduce Dr. Dvorkovitz to British gas engineers, inasmuch as his reputation as a petroleum oil and gas chemist is a matter of long standing. He takes himself very seriously as a leader of the "science" of petroleum, and is one of a band of professors of this science who seek to establish it as something more than a department of chemical industry. This being the case, it might have been expected that anyone who needed to be well posted in matters relating to petroleum should be able to rely implicitly upon a special journal devoted to the subject in all its branches, and personally conducted by Dr. Dvorkovitz. He, at any rate, is no tyro in the speciality.

Readers of the "Petroleum Review," whose reason for consulting its pages is of a business nature, must judge of the value of its contents by sample. In a recent issue—to be precise, that of June 15 last—there appeared an announcement of a piece of commercial intelligence qualified as being "likely to prove of paramount importance to the manufacturing industries of this country." This startling information was that "a contract has just been concluded between the J. M. Guffey Petroleum Company and the Shell Transport and Trading Company, for the marketing of all the products produced by the Guffey Company outside America." That is to say, that the much-boomed Borneo and Texas oil fields are henceforward to be worked together. Anything that bids fair to enlarge the world's facilities for procuring all the petroleum wanted for every purpose is to be welcomed; but seeing that the oil trade is not exactly philanthropy, it is expedient that its proffered benefits should be scrutinized very closely. Borneo oil is already, we believe, used to some extent in gas manufacture; notwithstanding the long way it has to come to reach the confines of civilization. Of the newer Texan product, little is known.

According to Dr. Dvorkovitz's paper, however, these two interesting products are to be largely marketed for gas making. The distributing power which the Shell Company can put at the disposal of the Guffey Oil Company, is stated to be a million tons per annum, which is further asserted to mean that "Texas fuel oil will be delivered at such a price as will enable it to compete on equal terms with coal in this and other countries." One may ask if this means that the Shell Line Company can handle a million tons of oil yearly, over and above their own product from Borneo—or does it mean that hey will carry Texas oil

in preference to their own? This arrangement, whatever it is, is to practically revolutionize the gas industry of this country. Dr. Dvorkovitz says he "has no hesitation whatever" in committing his journal to this statement; and he ought to know. This is how he works it out. He assumes the annual consumption of gas coal in the United Kingdom alone to be 15 million tons, which, he remarks, has to be of such a superior quality that the gas companies are compelled to pay more for it than other coal consumers for their own supplies. Much success has attended English efforts to substitute carburetted water gas for coal gas; "but it has not been possible to widely adopt it."

Henceforward, however, the case will be altered. Texas oil, containing "at least 30 per cent. more oil suitable for gas manufacture" (datum of comparison not stated) will therefore be available "at the gas-works in the United Kingdom at a price of 50s. per ton." Consequently, Dr. Dvorkovitz has "not the slightest doubt that this figure will induce every gas manager in the country to immediately abolish the old system of producing gas from coal by carbonizing it in small retorts, and will at once avail themselves (*sic*) of the application of solar oil as a substitute. If this course is adopted, and only half of the coal now used is displaced by carburetted water gas, the requirements of solar oil alone will be approximately a million tons per annum." After this, it is surely superfluous to dilate upon the readiness of manufacturers in other industries to adopt oil for fuel when the price suits. Several more fleets of tank steamers would be needed to cope with the business.

It has appeared to us to be an injustice to the gas industry that its followers should remain in ignorance of the vast revolution that, according to Dr. Dvorkovitz, is impending over their technic. If every gas manager in the kingdom is to have gas oil laid on at his discretion, at the small price of 50s. per ton, of course in doing away with half his coal retorts he will want the coke from the remainder to fire his generators withal. This will relieve the industry from another trouble. The tar, tar products, and ammonia trades will also be interested in this news.

Jesting apart, we venture to inquire what useful office this kind of technical journalism is likely to fulfil? Why "darken counsel" by swamping a piece of commercial news which is significant enough as it stands, with a mass of comment, and a flight of prophecy, which have no sound basis? It will take something more potent than the wind of a deal in Texan oil produce to the tune of even a million tons a year, to be delivered in the United Kingdom everywhere at 50s. per ton, to put out the fires of one-half of the gas-retort furnaces. What English oil buyers on the large scale would like to know is, how the Standard Oil policy, and the Russian pipe-line puzzle, stand affected by all these outside supplies. Dealing for oil supplies is a ticklish business, as many a gas manager has learnt during the last year. The supply of oil for the carburetted water-gas plants of the United Kingdom is by no means an automatic operation. Those buyers who would have the mastery of the market need a freer hand than most gas managers enjoy. The storage room for oil is no trifling consideration. Comparatively few gas-works have room enough for all the oil-tanks desirable.

The truth of the matter is that buyers of oil do not know nearly enough of the internal economy of the oil trade to feel sure of their ground in making their purchases. Not nearly so much is known about it as is common property in regard to coal. Apart altogether from the hypothetical talk about the probable duration of the British coal supply as a whole, it is safe to say that most buyers of gas coal in large quantities are fairly well posted in regard to the circumstances of their customary purveyors. Yet, notwithstanding this degree of knowledge and intimacy—notwithstanding the circumstance that the coalfields lie at the doors of many large eonsumers of the mineral—there came to pass the state of things in regard to the supply of gas coal which need not be particularized. Nobody knows who it is that is selling oil. The world's product of this commodity is in very few hands, and the secrets of the trade are impenetrable. It is for this reason, mainly, that all the theoretical demonstrations of the equivalent fuel value of mineral oil as against coal, for example, leave Englishmen cold. We have coal, and can always get it; because it is raised on the premises. Even so, there are sporadic troubles in this regard. It would be jumping out of the frying pan into the fire to rely much more on oil than we do at present.

The uncomfortable impression is prevalent, in regard to the sale of oil, that sellers make their own prices at will. This means that the whole trade is an artificial one, susceptible of being manipulated according to the suggestions of the market. While this belief prevails, it is idle to propose that oil shall be treated in all respects as an equivalent for coal. This would be tantamount to a kind of bimetallism in respect of hydrocarbon standard values, which would be unworkable. So long as the coal trade is in a normal state, trafficking in oil for any purpose will be relatively safe. The standard of value will be fixed by the price of coal. It is not the least of the deplorable results of that orgie of profit-grabbing in which British coalowners have indulged of late, that it permitted the oil-kings to swell their revenues and widen their economic frontiers. That debauch will have to be paid for smartly yet. Texas petroleum at 50s. per ton may be part of the fine levied by Nemesis on the British coalowner. If so, he has to pay it, and he may be thankful the punishment is not heavier; for, notwithstanding the perfervid accuracy of the "Petroleum Review," we cannot agree that there is anything in this to revolutionize the British gas industry.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 296.)

ANOTHER depressing week on the Stock Exchange has just closed. In special markets Home Railways were the most affected, where each successive announcement of dividend told the same tale, and a very unpleasant tale it was, too. The price of coal was, of course, at the bottom of it; and the reflection that for the current half year the price is much easier, happily dissuaded holders from sacrificing their stock, so that the actual fall in prices has not been excessive. But in many other departments there was a good deal of forced selling; and until the worst of this was got through, things were very flat indeed, though at the close a brighter view was beginning to be taken. In the Money Market there was at first great ease and quietude; but as the pinch in the Stock Exchange tightened, so rates hardened. There is, however, no prospect of material stringency. Business in the Gas Market was on the whole no more than moderate; and it was to a great extent confined to two or three of the leading stocks. There was hardly any movement in quotations; and the general tendency of the market may be written as steady. Most interest centred in Gaslight and Coke; the ordinary stock opening firm and advancing a point on Tuesday, with business marked at 96½. This movement would almost seem to have proceeded from a mistaken view in regard to the dividend announcement—as though the profits of the half year amounted to a surplus of £97,000 after providing for the statutory dividend—for later on, when the accounts were issued, the quotation relapsed; and the closing price was the worst of the week. The secured issues, too, were strong at first, probably from the same cause. South Metropolitan was a little dealt in every day, and at first gained half a point; but the closing price was weaker, and the debenture stock receded a point. Commercials were quiet and featureless. The Suburban and Provincial group was quite devoid of interest, and business was tame; all quotations closing without variation. Business in the Continental Companies was extremely light. Some Union of both issues was let go at very low figures, and depressed the quotation; but otherwise nothing moved. There was nothing in the remoter undertakings, save that the quotation of Buenos Ayres was drawn in closer. In the Water Companies, the only noticeable feature was a slight shrinkage in some preference issues.

The daily operations were: There was moderate business with steady prices on the opening day in Gas. In Water, Southwark preference fell 3. Tuesday was fairly brisk and buoyant. Gaslight ordinary rose 1, and South Metropolitan ½; but both Continental Unions fell 2. Wednesday was a quiet day; but some good prices were marked. However, South Metropolitan debenture fell 1. Thursday was unchanged. Friday's dealings were largely confined to Gaslight ordinary, which moved down 1. Saturday was very quiet. In Water, Chelsea preference fell 3.

PERSONAL.

Mr. J. T. BYROM will shortly leave Yarm to take the management of the Crook Gas-Works, which are to undergo considerable improvement.

Mr. ARNOLD E. MOTTRAM, Assistant-Manager at the Hyde Gas-Works, has been selected to fill the position of Gas Manager to the Ossett Corporation.

The workmen employed at the Brechin Gas-Works have presented Mr. ALLAN REID, the Manager, with a handsome marble timepiece, on the occasion of his marriage, together with a silver teapot for his bride-elect.

Mr. G. A. HORTON, who has been for some years Engineer-in-Charge at the St. Pancras station of the Gaslight and Coke Company, is retiring from this position (in which he succeeded Mr. John Clark), after thirty years' service with the Company. Mr. T. S. LACEY, who has been at the Pimlico station, will remove to St. Pancras. We understand that it is not Mr. Horton's intention to dissociate himself with the industry with which he has had practically a life-long connection.

It is with much gratification that we announce that Mr. JOSEPH MORRIS, Engineer and Manager of the Jersey Gaslight Company, celebrated last Friday the 71st anniversary of his birthday, and commemorated the jubilee of his professional connection with the Channel Islands. Mr. Morris entered the service of the Guernsey Gas Company on July 26, 1851 (which was a Friday), and passed into that of the Jersey Company in January, 1863. His many friends will, we are sure, join with us in offering him cordial congratulations, and in expressing the hope that he may be spared for many years to come to keep unbroken the private and professional associations formed in the long period just closed.

OBITUARY.

We much regret to record the sudden death on the 20th inst., at Margate, of Mr. WILLIAM CROXFORD, formerly Secretary of the Brentford Gas Company. This position he relinquished, through failing health, early last year, when he was succeeded by Mr. W. Mann. Deceased was in his 77th year.

Mr. JAMES HENDERSON, Manager of the Newton-on-Ayr Gas

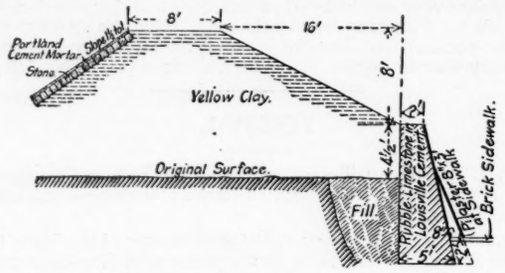
Company, died at his residence there on the 9th inst. He underwent an operation in Glasgow several months ago for an internal complaint. He seemed restored to health, and was able to go about again; but recently the malady returned with greater virulence, and his constitution, by that time impaired, was unequal to the shock. Mr. Henderson was a native of the Lanark district. He was a capable gas manager, and in private life was about the most happy and contented man who ever bore the human image.

The Parliamentary Bar has been deprived of one of its most distinguished members—in fact, its leader—by the sudden death of Mr. SAMUEL POPE, K.C., which took place at his residence, in Ashley Gardens, Westminster, on Monday night last week. As recently as the previous Friday, Mr. Pope had been engaged in professional work; but he was prostrated by an attack of gout on Saturday and Sunday. On Monday, however, he was rather better, and on retiring to rest at ten o'clock seemed comparatively well. Shortly afterwards he was found dead in his bed; having passed away quietly in his sleep. Mr. Pope was called to the Bar by the Middle Temple in 1858, and joined the Northern Circuit. In 1865 he came to London; and, as our readers are aware, from that time his practice was confined to the Parliamentary Committee-Rooms. There have been very few Gas or Water Bills of any importance on which he was not engaged; and only a few days ago he appeared for the Gaslight and Coke Company on the South Metropolitan Gas Bill in the House of Lords. He was appointed Recorder of Bolton in 1869. Sympathetic allusions were made on Tuesday to Mr. Pope's death, by Mr. Pember, K.C., and Mr. Balfour Browne, K.C.; while Lords Ribblesdale and Hatherton expressed in feeling terms their sense of the loss which Committees not less than the Bar had sustained. A largely attended memorial service was held in the Temple Church last Thursday afternoon; and the body was subsequently removed to Llanbedr for interment with deceased's wife. This took place on the following day.

NOTES.

Moving a Retaining Wall.

The accompanying illustration, for which we are indebted to the "Engineering Record," shows how a retaining wall, holding back one side of a service reservoir at Ottumwa (Iowa), was pushed forward bodily upon its base from 1 to 2 feet, except near the centre, where 6 inches of the batter was taken up by turning the



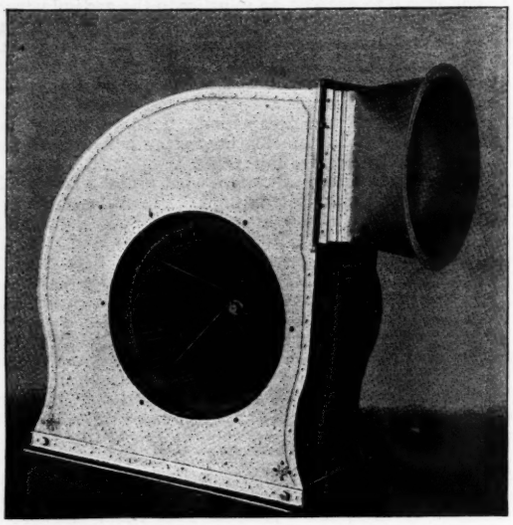
wall on its toe to this extent. The illustration is a cross-section of the wall and embankment, and it is given on the authority of the City Engineer (Mr. John T. Brady), who states that at the place marked "Fill," there had been a cave-in after the street grade was lowered, at which time the wall was built. The pilasters on the face of the wall were spaced 16 feet on centres. The sliding of the masonry followed the laying of a switch in the street, for which purpose some of the pavement was taken up. The bricks in the sidewalk were pushed up, and the kerbstone was broken in places. Beyond, and at the top of the wall, the bank between the masonry and the reservoir dropped 4 feet or more for a distance of about 12 feet back from the coping.

Supply of Petroleum for Wickless Lamps.

An important question arising in connection with the various new lamps for burning petroleum oils without a wick, refers to the permanence or otherwise of the oil at high temperatures. Gawalowski explains the comparatively small use of naphtha for lighting purposes, by ascribing it to the tendency of this distillate to form tar and coke at high temperatures. There has of late been a fresh start in the production of petroleum lamps of the wickless order, for different purposes; but the ideal has not yet been attained, as they all in time get their tubes choked with tar and coke, says the German writer, and then the whole apparatus becomes useless. The conclusion is that the blame does not rest upon the lamp, but upon the oil, which has not yet been put upon the market in a permanent state. Further improvement must take the shape of freeing the oil from those readily decomposable constituents which are responsible for the separation of pure carbon. Researches have already shown that this is not an easy business. The stability of a sample of petroleum oil can be tested by distilling a small measured quantity—say 5 cubic centimetres—in a glass retort, the beak of which is passed through a sand jacket maintained by a separate burner at a temperature of 275° C. It takes about fifteen minutes to distil off the petroleum to a small residuum, when the beak of the retort (which has been connected to a condenser) is withdrawn from the sand for inspection. In the case of an oil of the highest degree of stability, the tube is clean. The next grade will have left dirty marks; and so on, until some oil will show a solid black deposit. The truth is the vapour of all naphtha products begins to decompose at or below 250° C., and raw petroleum decomposes most. So-called refined petroleum oil will not always stand this test. Petroleum which will not stand the test cannot be made to do so by any purification method yet known. The most important conclusion to be drawn from the test is that wickless petroleum lamps require a better quality of oil than those with wicks, and that for such lamps of the highest quality a sort of oil is wanted for which ordinary tests are useless.

The "Sirocco" Fan.

The "Engineer" has published illustrations and particulars of the "Sirocco" fans manufactured by Messrs. Davidson and Co., Limited, of Belfast, which are so well spoken of in connection with the improved ventilation of the Royal Courts of Justice. The fans can, of course, be used for forced draught for boiler working and other purposes. The makers claim that they constitute a new departure in the science and operative principles pertaining to the construction of centrifugal fans; and these fans certainly differ from the usual pattern in many respects. Chief among these is the shape, size, and number of the blades. They are very numerous, and short in the radial sense. The accom-



panying illustration gives a good idea of this peculiarity of a "Sirocco" fan. All the working parts seem to have been proportioned from direct experiment. Thus, the number of blades is 64 for a considerable range of sizes of the fans; and the blades are one-sixteenth of the depth of the fan, and three-fifths of its width. These are peculiar proportions for such an apparatus. Moreover, the outer edges of the blades are set forward to a particular angle in the direction of rotation; and at one end they are slightly cupped. The net effect is that the fan works without eddies; and the delivery of air is at about 80 per cent. greater velocity than the peripheral speed of the blades. In the illustration, the inlet-eye is removed so as to show the rotary member. The fan works well as an exhauster of hot furnace gases, for induced draught systems of combustion.

Designing Ironwork.—We have received from Mr. Henry Adams, M.Inst.C.E., Professor of Engineering at the City of London College, Part II. of the second series of his "Notes, Formulæ, Calculations, and Working Drawings for Built-Up Steel Stanchions." The author points out in his preface that the modern use of steel framework in the construction of high buildings makes the study of built-up stanchions of importance; and he gives a number of useful references to the literature of the subject. The text of his *brochure*, which occupies 56 pages, is accompanied by two folding plates.

Manchester District Institution of Gas Engineers.—The Committee of the Institution are making arrangements for holding the 127th quarterly meeting at Grantham on Saturday, the 14th of September. Owing to the long distance which most members will have to travel, and the various places of interest proposed to be visited, it has been decided to form an advance party of such members as are desirous of reaching Grantham on the previous day. This contingent will devote all their spare time to special arrangements made by Mr. Shadbolt. The party will then meet the members travelling to Grantham on the Saturday, and, after the usual business has been transacted, a visit to Belvoir Castle is contemplated. An official programme will be issued in due course; but, in the meantime, we are asked by the Hon. Secretary (Mr. J. Wilkinson, of Drighlington) to indicate the decision of the Committee, in order that members may have ample time to decide which party they will join.

TECHNICAL RECORD.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Glasgow.

The Fortieth Annual Meeting of the Association was held in the Humanity Class-Room of the Glasgow University on Thursday last. Mr. W. R. HERRING, Chief Engineer and Manager to the Edinburgh and Leith Corporations Gas Commissioners, the President for the year, was in the chair. There was a very large attendance of members.

The PRESIDENT, in opening the proceedings, said: Allow me to first express my pleasure at seeing such a large gathering here this morning. As you know, it is the first meeting in a new century, and, as you see, we are permitted to meet in this splendid hall within the precincts of this grand old University. May we not accept it, perhaps, as an omen of the position, both learned and social, the gas manager of the future is to occupy? Most of us have, perhaps, had to forge our way through without the advantages of a university education; but, thanks to Mr. Carnegie, these facilities are now within the reach of all who show the slightest ability and the least inclination to receive such teaching. Having such advantages at the command of all, it must have a very important influence upon industrial progress, and, I may say, on the supremacy of this country in the future. We have all come across, in our time, men who have not had even an elementary education, but who would have been stars in their different occupations and professions had they had facilities for an early education. That is now within the reach of all of us. During the year death has robbed the Association of several of its members. In all probability, the death of Mr. James Henderson, the Vice-President for the year, is the most pathetic of all. In ordinary circumstances, had he been here, he would have been elected President of the Association. He had, I am sorry to say, suffered seriously for many months past; and death has at last eased him of his pain. We have also lost Dr. Stevenson Macadam, of Edinburgh, whose career as a scientist was well known to this Association. The deep interest he took in the Association has been recorded in its transactions from time to time. His genial disposition endeared him to all who came in contact with him. He also is gone. Then, again, we have lost Peter Stewart; of Stranraer; James Donald, of Paisley, and James Slight, of Glasgow. I have to apologize for the absence of Mr. Hall, of Montrose, who, unfortunately, cannot be here; of Mr. M'Gilchrist, of Dumbarton, whose brother died very suddenly at the end of last week; and of Mr. M'Crae, of Dundee, who has also intimated that he regrets his inability to be present with us to-day.

COMMITTEE'S REPORT—STANDARDIZING METER-UNIONS.

The SECRETARY (Mr. R. S. Carlow, of Arbroath) then read the report of the Committee. It set forth that the Benevolent Fund had not been drawn upon during the year; that at a meeting of the Committee of the Association on April 3, circular-letters were submitted regarding the International Engineering Congress which is to be held in Glasgow in September, and that the Committee, after careful consideration and discussion, had agreed to accept the invitation from the Council of the International Congress; and that invitations, received from the Secretary to the Congress, had been posted to all the members of the Association. On the subject of the standardizing of meter-unions, the Committee reported that at a meeting on the 15th of January, they instructed the Secretary to send out circulars to all Gas Managers' Associations and all meter-makers in the United Kingdom, stating that while the North British Association were quite prepared to delay for a short period the introduction of their interchangeable standard, they were not prepared to recommend its delay longer than the 1st of January, 1902, unless there were clear indications of the question being promptly dealt with by kindred Societies and meter manufacturers; that at a meeting of the Committee, held on the 9th of July, the Secretary read replies he had received from the different Associations and meter makers; that the Committee gave those replies their careful consideration, and it was resolved, seeing that there were such diversities of opinion on the subject, and no likelihood of the question being settled soon, to recommend on and after Jan. 1, 1902, the adoption of the Chaney standard meter-unions, and to request all gas managers in Scotland, when ordering meters, both wet and dry, to distinctly state that they wanted them fixed with these meter-unions, and to see that this was done. The Committee, at a meeting held that morning, unanimously agreed to recommend that Professor Ivison Macadam, Lecturer on Chemistry in Edinburgh, and Mr. Samuel Stewart, late of the Greenock Gas-Works, be added to the list of honorary members of the Association. The report further showed that the names of thirteen ordinary members had been removed from the roll, on account of resignation or otherwise; and that the names of one honorary, three extraordinary, and two associate members had been so dealt with. The membership of the Association was thereby reduced to 220. The following applications for admission had been received:—

Ordinary Members.—Bell, J., Callander; Cochrane, J., Darvel; Gemmell, J., Melrose; Gourlay, H., East Wemyss; Graham, G., Leslie; M'Nair, Hugh, Renton; O'Neil, J., Old Cumnock; Readdie, P., Leven; Reid, A., Brechin.

Associate Members.—Rule, H., Falkirk; Shea, H., Arbroath.

Extraordinary Member.—Watson, J., Colliery Agent, Glasgow.

These, with the two honorary members proposed, made up the membership to 239.

The PRESIDENT said that, before formally submitting to them the report, he was sure it would need but few words from him to commend to them the names of Professor Ivison Macadam and Mr. Samuel Stewart, of Greenock, for election as honorary members of the Association. The name of Macadam was closely connected with the Association from the beginning; and though the distinguished father had gone, they felt that they had in the son one who was calculated to fully come up to the high plane the father occupied in the scientific world. Mr. Samuel Stewart, of Greenock, unfortunately, was not in the best of health. He had had to resign his official position in the gas world, in so far as the active management of works was concerned; and he was sure it was the wish of all that Mr. Stewart should still be closely connected with them in the North British Association. Perhaps, before submitting the report, some few words of explanation might be given regarding the much-vexed question of the interchangeability of meter-unions. A proposal was put to them before, and determined upon. But circumstances had changed, as they had heard from the report; and the Committee thought it wise to delay for a little while the adoption of last year's resolution. At that time, they agreed to accept an interchangeable or accommodating set which, he thought, none of them had then seen. A circular was sent out to the different Associations, and replies were requested. In the meantime, some of them (and, among others, himself), by a little strategy, got hold of sets of the interchangeable unions. He had them tried on different makes of meters; and while they were accommodating in that they did fit the different makes, to him they were not an altogether satisfactory set. They were not what they might expect, in these days of mechanical science, to be issued by an Association representing either gas engineering or any other branch of engineering. The replies received to the circular were of a very diverse character, and led them to suppose that there was no more interest being taken in the subject in England than had been shown before. Therefore, at the last meeting of the Committee, the question was discussed; and the information which was then put before the Association was this: It was discovered that the Chaney standards were a set which were made by Mr. Chaney's instructions, and belonged to the Board of Trade. It was also found that fully 75 per cent. of the meters in existence were fitted with this coupling. As a set-off against this, they had to face the fact that the North British Association had prepared a set. But after considering the matter, it was thought that they would scarcely be justified in introducing an additional complication in the matter of meter-unions, when it was easy to adopt the Chaney set, which was so universally used, and thus practically inaugurate one standard for the whole of the country. As they knew, a conference was being held that day in London, in regard to the question of meter-unions; and there was an idea that they should have the subject deferred again and discussed at the Engineering Congress to be held in Glasgow in September. The Committee did not think it necessary to delay the subject any longer. It had been discussed at their meetings so long, that it was time a decision was arrived at; and, as they saw by the Committee's recommendation, they suggested that the meeting should finally determine to adopt the set of standards which had been prepared and deposited with the Board of Trade, although they had not been adopted by the Board of Trade, and would not be until they requested them to do so. He did not know if any further information or explanation would be asked in regard to this matter; but he would be very happy to give any explanations, if they should be asked. He might say that they had a set of standards there, prepared by Messrs. Parkinson and W. & B. Cowan, Limited. It was, he believed, the Chaney standard pure and simple. They had also before them the set made with the Whitworth thread; and they had the set which they might call the accommodating set, and which they did not after all care to advise them to adopt. If anyone desired to say a word before he put the report to the meeting, they would be glad to hear him.

Mr. J. NAPIER MYERS (Saltcoats) asked if the meters now in use in London were fitted in accordance with the Chaney standard.

The PRESIDENT said he understood so.

Mr. MYERS remarked that his name had been identified with the matter of meter-unions perhaps more than he liked; and he felt called upon to say a word now. The subject had certainly been before the Association so long that he could sympathize quite with their feeling of weariness of it, and their desire to have it closed and put aside. The Committee had recommended to them one set of standards which they made in steel; they had recommended to them a second set of standards which was made in brass; and he now understood that they were recommending a third set of standards which was at that time in London. Certainly the unofficial members on the benches there were not in a position to judge as to which of the standards should be accepted. It was something like the three-card trick—they put the standards before them, and asked them to decide upon one. He certainly did not feel in the position of being able to vote upon these standards, and he thought that the matter might be still further delayed—

notwithstanding the sense of weariness that must exist in Committee upon the question—for final settlement until the Engineering Congress. He had had, in England, some experience of the unions that were recommended. These standards, he believed, prevailed in London, Exeter, and Newport; and his experience of them was such as to lead him to realize the benefit there would be in the interchangeability of unions. His objection to them was that, while he realized the benefit of interchangeability, he thought in the standards the thread was too thin. The variations which existed in gas-fittings sometimes put them out of line with one another; and when this took place in a country gas-works, the manager had no screwing tackle to enable him to deal with it. This consideration was chiefly in his mind in recommending that meter-unions should be so made that any alteration which was required could be effected on the spot. He still held to the opinion that the gas-tube thread was the one which should be used for meter-couplings; and he thought that Mr. J. F. Bell, of Derby, was of the same opinion. He had read Mr. Bell's paper very carefully; and it seemed to him to be quite in line with the resolution come to by the Association some years ago.

The PRESIDENT said the Secretary called his attention to the fact that Mr. Myers had suggested that the Committee recommended a set of steel standards, and then another set; but the Secretary said they did not recommend either, because they had not at that time seen them. It was only last year, as a way out of the difficulty—having seen that their standards would not be generally adopted—that they agreed to a proposal by the makers. But the real point at issue, he thought, was that they wanted to be able to exchange one maker's meters with another, by means of a common set of couplings. There were very few meters at the present day that were coupled direct with iron—in fact, it would be a very risky thing to attempt to couple a meter with iron—but even if they were inclined to do this, he was afraid they were helpless, or powerless, to do it. They had accomplished a great deal. The North British Association must necessarily have the credit of introducing a uniform coupling; and he thought the best way out of the difficulty was to adopt that which was most easily accomplished. If they found it was a good workable coupling, and that 75 per cent. of the meters in use were fitted with it, though they might not obtain all they wanted, they were getting a great deal if they could establish, once for all, a standard of meter-couplings that makers would no doubt be ready to adopt. Therefore, unless very strong reasons could be shown to the contrary, he thought the recommendation of the Committee should be most strongly supported.

Mr. MYERS asked whether, if they adopted this recommendation, they were not, in a manner, discourteous to those other Associations which had the matter under consideration. Were they not stealing a march upon them, by jumping to a conclusion in regard to the Chaney couplings?

The PRESIDENT said he thought not. The North British Association had had the subject before them so often that they would be quite justified in coming to a decision. He did not think there would be anything discourteous in it to other Associations. Their having adopted a standard would have a greater tendency to settle the matter for good and all than anything they had yet done.

Mr. A. WADDELL (Dunfermline) said he understood that there was very little difference, after all, between the two standards—that, in fact, the loose parts of the coupling of the one which was recommended suited everyone of the North British standards which they had previously recommended. The difference was in detail; and it would be an unfortunate thing if, after the trouble there had been, they should stand in the way of accomplishing what could be done by the meeting that day, if they agreed to adopt the Chaney standards. He understood that the thread in the Chaney standards was very neat, and quite suitable for the work. He had been told by one who had been using them, that they would suit those of the Association. If the Association stood by the steel standards, and asked that they should be made for Scotland, they would be outside what was being used elsewhere—in England, at any rate.

The PRESIDENT suggested that perhaps the meeting would like to hear Mr. Hepworth's remarks upon the subject, and thus have both sides of the question before them.

Mr. J. HEPWORTH (Edinburgh) said he had had no intention, and he certainly had no desire, to add to what he had already said on the subject. They might be assured that the meeting which was being held that day would go into the matter very fully; and it might seem, perhaps, more courteous that the decision of the Association should be deferred until after the Engineering Congress had been held. But he did not think they could take this into account very seriously; and he, for one, should be most happy to fall in with the recommendation which had been suggested by the Committee. It was a business-like decision to come to. They would be adopting, it appeared, what was employed to the extent of 75 per cent. of the meters in use; and if they did this, the presumption was that the meeting which was being held in London that day would do the same. Certainly, he thought, they should make a move in the direction of greater uniformity than they could secure by the adoption of any other standard that had been proposed. He was heartily with the Committee, though he was not aware what their decision was until he heard it in the report.

Mr. A. WILSON (Dawsholm) said that, as one who had a great deal to do with the getting up of the North British meter-unions, he thought it might be wise, considering the large extent to which the Chaney unions were used, to give the Committee power to recommend their adoption at the date they mentioned, in view of the other meeting which was being held that day in London. Perhaps it would be better to give the Committee power to sanction the adoption of the Chaney unions, instead of themselves coming to a decision to adopt them. The Committee would see what would result from the meeting in London, and would have both sides of the question before them. He was sure that those who got up the North British unions were moved by a desire to meet all parties. There was at that time a generally expressed desire that they should take the Whitworth thread. If this were not so now, he thought it would give general satisfaction to adopt the other; but to do away with any appearance of discourtesy, he thought they should give the Committee the power which he suggested. He moved to this effect.

The PRESIDENT thought that was a very happy result.

Mr. C. P. MYERS (Troon) seconded Mr. Wilson's motion.

Mr. J. N. MYERS said he thought they should rather adopt it themselves than give its adoption out of their hands altogether; for practically that was what was proposed. It would be better that the adoption should go forth with the *imprimatur* of the Association as a whole, rather than as a secondary adoption; and with this in mind, he had pleasure in moving the adoption of the report.

Mr. WILSON (with the consent of his seconder) said he had great pleasure in withdrawing his motion in favour of that of Mr. Myers.

Mr. D. ROBERTSON (Dunoon) seconded Mr. Myers' motion; and it was unanimously adopted.

THE AUDITOR'S REPORT.

The AUDITOR (Mr. R. B. Main, of Glasgow) said that the funds of the Association were in a very flourishing condition. The decision they came to some years ago to have the accounts printed, saved a great deal of trouble, and saved their time as well. He should like to bear testimony to the excellent manner in which the books of the Association were kept by the Secretary. The careful manner in which the various documents and vouchers were put before the Auditor saved a great deal of his time, and made his work much lighter than it would otherwise be. He had much pleasure in moving the adoption of the report.

This was agreed to unanimously.

The PRESIDENT said that, in case the Auditor should leave the meeting, he would at once move a vote of thanks to Mr. Main for the attention he gave year by year to the affairs of the Association. They were all assured of the correctness of the statements he put before them.

Mr. MAIN expressed his obligation to the members for the vote.

THE PRESIDENT'S ADDRESS.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I have first to thank you for the honour you conferred upon me last year by electing me President of the North British Association of Gas Managers. My residence in Scotland has been so short as to scarcely warrant my anticipating such high esteem at so early a date; and I cannot but feel that I have taken the place of others, who were more fully entitled to this distinction at your hands. It is doubly gratifying to me to have received the honour at the hands of the members of an Association which has the distinction of being the first organized body of men representing the profession of gas engineering—an Association from which has sprung the many kindred associations existent throughout all parts of the civilized world, organized for the purpose of considering from time to time the *technique* of the profession by the compilation and reading of papers and the discussion of the same. What is of even greater importance, is the friendly intercourse that such Association engenders between man and man; bringing forth an interchange of opinions upon the doubts and difficulties arising from day to day in the every-day practice of our calling.

The complexity of the many problems which arise for elucidation from time to time are familiar to us all. Each period appears to have its topic; the very elements of our practice being constantly reviewed. At the present day, nothing can be taken for granted. The fact of certain practices having been existent in the past is the strongest reason why their very existence should be questioned from time to time, and the simple question frequently asked, What is the object in view? What is the purpose to be accomplished? And is what we are now doing, and the means we employ, the most efficient and economical way of doing it?—accepting nothing as good until we are convinced of the impossibility of doing it in a better way. This exercise demands a considerable amount of self-restraint and level-headed consideration, without which there will be a great danger of changing for the mere sake of novelty. But it is only by this means that we can progress on the right lines, and really accomplish something more than has hitherto been done.

The systematic adoption of applied science in the development of the industrial world has rendered many things possible to-day that were impossible but a few years ago. Contrast for a moment an old-time retort-house with a modern one. In the former, coal was delivered by carts, or wheeled from the yard or dropped from the waggons, and lay in heaps upon the floor ready for

charging. The coke was also piled in heaps ready for feeding the furnaces. For the removal of the surplus coke, nothing better than the two-wheeled barrow was known. Shovels, barrows, rake-rods, water-tanks, buckets, &c., were inconveniently in the way; and the general impression, with but few exceptions, was one of confusion, which has often been likened to those regions from whence no wanderer returns.

Take the modern retort-house with an inclined retort installation. You will see neither coal nor coke, although there will be at least twelve hours' supply of coal within the building at the time you enter it. Wheel-barrows are conspicuous by their absence; the coke being automatically transshipped from the building in a closed trough, where it is quenched, the steam and vapours arising therefrom being drawn into ducts discharging above the retort-bench level. The operators are not even exposed to the heat of the coke during the process of drawing. A traversing screen is wheeled in front of the particular retorts to be drawn, the contents of the retorts being discharged against the screen and directed into the coke-conveyor on the floor. Altogether the atmosphere and the aspect of the place is far more heavenly than the one with which it is contrasted; and the physical exertion is reduced to a minimum, as compared with the old type charged and drawn by hand. Surely, this is progress; and it is curious to reflect why we have been so long in accomplishing it. The inclined retort is not new; it is as old as the industry itself. It is rather the stress of commercial existence and the industrial developments of the times that have put in our way means of handling our material which formerly were non-existent. It is for this reason that we should exercise our faculties to the utmost in watching the progress of other industries than our own, and in selecting and applying, and if necessary adapting, means to accomplish similar purposes in our own.

The great commercial changes which have come over the country in the past twenty years also compel us to seek new means of accomplishing old purposes. To-day in the land of cannel gas there is a wide cry for its abolition in the use of gas manufacture. This has arisen in consequence of the high price of the material; and in some cases substitutes have already been found which will supplant it on its present cost. It has long since been knocked out south of the Tweed—carburetted water gas and vapour enrichment having almost entirely supplanted it. These agencies bid fair to run it out of the Scottish works, for the simple reason that other means can be employed of enriching the gas that are cheaper in the end. Taking, for example, the cannel produced in the Midlothian district, I find, from experience, that in practical working we realize an average of 11,750 cubic feet of 28·05-candle power gas to the ton. This, when carbonized with splint coal, yields 12 to 15 per cent. more illuminating matter, which we will term its enriching value, when carbonized with common coal. The ton of cannel therefore yields 75,787 foot-candles. One ton of oil used in conjunction with water-gas production yields 68,570 cubic feet of 28·05-candle power gas, or 385,135 foot-candles.

Before we can arrive at their relative value, their net cost, after deducting the return for residuals, must be ascertained, and the cost of coke and water added to the carburetted water gas. This, in my own case, leaves them as follows: Cannel, 20s. 8d. per ton; oil, 84s. 8d. per ton. Reducing these to actual costs per thousand of foot-candles, we arrive at the figure of 3·27d. for cannel and 2·64d. for carburetted water gas. Comparing cannel with a direct manufactured oil gas, I make it out to be 3·27d. for cannel, as against 2·50d. for oil gas. I have no figures derived from my own experience as to the relative costs of vapour enrichment on the scale that we in Scotland should require to use it; but sufficient has been shown to prove that the present price of cannel is excessively high, and that oil, either as oil gas or carburetted water gas, is 24 per cent. cheaper than cannel. In other words, the cannels dealt with, as compared with the splints, are worth only a fraction more than twice the cost of the splint coal.

The output of cannel during the past twenty-four years has been as per the following statement:—

	Tons.		Tons.		Tons.
1876 ..	270,000	1885 ..	352,500	1894 ..	501,000
1877 ..	268,000	1886 ..	480,500	1895 ..	534,000
1878 ..	293,000	1887 ..	432,000	1896 ..	562,000
1879 ..	267,500	1888 ..	424,000	1897 ..	523,500
1880 ..	304,000	1889 ..	439,500	1898 ..	476,500
1881 ..	303,000	1890 ..	516,000	1899 ..	451,500
1882 ..	314,000	1891 ..	547,000	1900 ..	485,500
1883 ..	312,000	1892 ..	555,000		
1884 ..	333,000	1893 ..	549,000		

I suppose we may safely conclude that the bulk of the increased quantity is for shipment abroad, and not for home consumption. It is also interesting to note that during the years 1898 to 1900, when common coal was fetching such high prices, the mining of cannel coal appears to have been neglected to some extent. Doubtless when common coal is realizing three times its normal price, it pays better to mine it than to turn attention to cannel coal, which is no doubt a little more costly to bring to the surface. The figures are, however, instructive so far as they go, and justify our concluding that it does pay to mine cannel, even when its selling price is less than the ratio I have given. Consequently, it pays well to bring it to the surface when it is only double the price of the common coal for the time being. If it were not so, there would have been a much greater falling off in the output during 1898 to 1900, when coal was fetching from 15s. to 18s. and cannel 26s. to 27s. per ton, than the figures appear to show.

The tax upon exported coal is not calculated to render much service to the gas industry, unless it is laid upon an *ad valorem* basis. It does seem strange that the cannel coal, of at least four times the value of the coke yielded by it, is taxed upon the same basis. The rebatement that is to be allowed upon the lower-grade fuels will relieve us to some extent; but I do not see what precautions are to be taken by the Excise Authorities to prevent one entering into a contract for (say) 10,000 tons of coke in the summer time for shipment during the year at 6s. a ton, and, again, selling 2000 tons in the winter time at 15s. a ton—thus paying only £100 of duty, instead of £600, and yet realizing an average of 7s. 6d. for the coke.

The reduction of the illuminating power of Scottish gas is certainly a topic of the present. The characteristic difference between the Scottish and English gas is the higher illuminating power in Scotland as compared with England; the average in England being from 15 to 16 candles, and in Scotland from 23 to 28 candles. It cannot be stated that the relative efficiency as regards illumination is so marked. In England a consumption of from 4 to 6 cubic feet per burner per hour is the rule; whereas in Scotland it is from 2 to 3 cubic feet. So that relatively per burner the illumination yielded is the same. The practice of supplying a high illuminating gas, and using a small quantity of it, was no doubt founded upon sound economic principles in the first instance; and even now, in some localities, it is still more economical to supply the higher than the lower grade gas.

Some light is thrown upon this aspect of the question when we compare the relative consumption per consumer in the average English town and the Scottish town. In Scotland, it is 19,890 cubic feet, as compared with 38,660 cubic feet in England. This difference is not entirely to be accounted for in consequence of the higher illuminating properties of Scottish gas; but it must make its influence felt. The differences in the habitations of the people in the two countries no doubt account to a considerable extent for the small consumption in Scotland as compared with the consumption in the self-contained houses of the working classes which almost predominate in all English towns. I do, however, think that the basis which founded the policy of a high-grade gas may be profitably reconsidered in the light of present-day facts; and the only satisfactory lines on which this can proceed, is for each locality to determine the question for themselves, by computing at what price they can afford to sell a gas manufactured from coal alone, and comparing it with their present costs and quality, whatever they may be.

I have recently had to devote some time to this question myself with regard to the gas supply area of Edinburgh and Leith; and in order to work upon facts rather than estimates, I have had a statement prepared of the actual weights and rates paid for the various classes of coal used from the year 1895 up to date, the average illuminating power for each year, and the quantity of gas sold per ton. From these facts, I have been able to estimate what would have been our costs if we had supplied a 20-candle gas and a gas produced from common coal only—in the latter case taking due note of the fact that a lesser yield per ton would be the result. I am not at liberty to disclose these facts to you at present, as they form the subject of a report to my Commissioners, which will no doubt see the light of day when they have considered the matter. I do, however, suggest that, unless we are enabled to sell our product at a considerable reduction upon the prevailing rates by abandoning enrichment, we shall not be justified in disturbing the established order of things for the sake of saving 2d. or 3d. per 1000 feet to the consumer. I am rather inclined to suggest that he would prefer to pay this additional cost than have the lower-grade gas.

Probably the case of Edinburgh is exceptional. We are in the locality of the principal high-quality cannel-producing coalfields; and our railway rates are, on the average, less than 1s. 6d. per ton. There are, however, doubtless many works in Scotland that are not so favourably situated, and where the differences in the cost of supplying a 15 and a 25 candle gas would be so great as to induce the consumer to accept the lower grade at a cheaper price than he at present has to pay. Take, for instance, the case of Edinburgh and Glasgow, and quote from figures published in "Field's Analysis" for the year ending March and May, 1900, respectively. The average cost of coal and cannel to produce a 25·18-candle power gas was in Edinburgh 15·75d. per 1000 cubic feet sold; whereas in Glasgow a 20·97-candle gas cost 17·16d. per 1000 cubic feet sold. With such divergent circumstances, therefore, to deal with, it would be unwise to lay down any arbitrary standard for the quality of Scottish gas. It is a question for each locality to determine in accordance with its own conditions.

There is, however, another aspect of the question which is worthy of the consideration of consumers, and that is the difficulty of properly consuming a gas of 25-candle power in the ordinary burners such as we have at our command. There is no doubt that a great deal of complaining about gas dirtying the walls and ceilings of rooms is attributable to the burners being unsuitable for the high-quality gas. The higher the quality of gas the greater the tendency to smoke, and thus produce dirt and its consequent disfigurements. The slightest draught upon a burner consuming this quality of gas invariably causes it to smoke. It is therefore a question whether some diminution in the quality of gas should not be brought about, not for the resulting economy, but to enhance the cleanliness in domestic use, stoves, &c.

I have already briefly touched upon some differences as between the Scottish and English practice in gas manufacture; and it may

be of interest if we proceed a little further in this respect. The distinctive characteristics in the practices of the two countries is the large percentage of cannel coal used in Scotland, and the resulting high illuminating power of the gas as compared with England. The use of this large percentage of coal unusually rich in volatile hydrocarbons necessitates a high temperature, or what is commonly defined as a sharp heat, for its efficient gratification. We are fortunately able to lay our hands upon very high-class fire-clay goods, which will enable us to carbonize heavy charges of coal and cannel in three and four hours; but even under these conditions, the gas is liable to contain a fairly large percentage of the vapour of hydrocarbons, as distinct from fixed gases. Such being the case, it is important in the first instance that the cannel and the common coal should be mixed together before being charged into the retorts in which they are to be carbonized. By this means, the enriching value of the cannel is taken advantage of to a much greater extent than by the mixing of the two gases after passing the hydraulic main. The practice in England is to carbonize the cannel in separate retorts, in order to avoid the depreciation of the resulting coke by admixture. This practice, however, must result in considerable loss in the absorption of the rich hydrocarbons by the contents of the hydraulic main.

The condensation of the higher-grade gas is also a matter of superior importance. The loss in the illuminating power, through rapid condensation or by subjecting the gas to shock, is much more pronounced when cannel gas enters largely into the composition of the whole than in the case of gas made from ordinary coal. For this reason, therefore, it seems to be very important that the arrangements for the gradual cooling of the gas should be more carefully devised. In England, I found considerable advantage by conducting the gas through a long length of foul main of considerable area within the retort-house, the superficial area of which represented 2·6 superficial feet per ton of coal carbonized; the mains being arranged in a coil within the circular girder roof of the retort-house, similar to the arrangements shown on the diagram I exhibited last year before this Association,* and having an inclination in the direction of the retort-bench. The whole of the condensation in these mains traverses against the flow of the gas, back to the end of the foul main on the bench; the tar and liquor from the hydraulic mains being conducted separately to the tar-well. I was never able to ascertain the exact efficiency of such an apparatus, on what might be termed the scientific basis. The general results, however, satisfied me that we were getting a tantamount advantage in the illuminating power of the gas, as well as in the uniformity of the quality from hour to hour. An exactly similar arrangement is now being introduced at the Granton works—the mains having a superficial area of 1·25 superficial feet per ton of coal, the gas subsequently passing through water-tube condensers in order to have absolute control of its issuing temperature before proceeding to the washing and scrubbing plant.

The ammoniacal liquor resulting from the carbonization of Scottish coal also possesses distinct characteristics as compared with the English; and this undoubtedly points to some different characteristics in the gas also. The analyses of the liquors produced at the Edinburgh and also at the Leith works show that they contain but little sulphuretted hydrogen—not more than from 7 to 9 per cent. The bulk of the liquor is carbonated; in other words, the liquor shows a much greater preference for carbonic acid than for sulphuretted hydrogen. I cannot say that our processes at Edinburgh are exactly scientific. When I say that they are not scientific, I mean that we still lose considerably, owing to the fact that the weak liquors from the hydraulic mains and condensers are allowed to flow direct to the tar-well, where they mix with the strong liquor. The ammoniacal liquor collected in the hydraulic mains and condensers, although weak in ammonia, is for all practical purposes a solution of pure ammonia, without being in any way fixed in the form of sulphides or carbonates. This solution is therefore eminently suitable for removing from the gas carbonic acid and sulphuretted hydrogen, having a decided preference, if properly handled, for the carbonic acid. I think, therefore, we should be very careful to conduct this alkaline solution to a separate receptacle, from which point it should be handled separately, cooled to a suitable temperature, and made to meet the foul gas upon entering the ammonia purifying plant. By this means, we shall take advantage to the fullest extent of its property for the removal of carbonic acid gas, and in a proportionate degree save our lime and the labour associated with its manipulation in the dry purifiers; the gas afterwards passing forward in the ordinary apparatus (preferably of the rotary type) from chamber to chamber, meeting with strong liquor first, and finally leaving the apparatus through clean water. I have recently arranged that one rotary scrubber should be made to accomplish the double purpose previously sketched.

The method of purification of coal gas in Scotland does not materially differ from those in England, although oxide of iron appears to be used to a much greater extent in England than in Scotland. If the process of washing and scrubbing briefly referred to turns out to be the success that I anticipate, and we can get rid of the bulk of the carbonic acid gas in that way, I think the extended use of oxide of iron for purification in Scotland is almost sure to follow. For two winters past I have been using oxide of iron alone at the Portobello Gas-Works, and testing the gas day by day for carbon bisulphide in the finished gas, the average of which I find to be 19·62 grains per 100 cubic feet. This, therefore, is within the limits prescribed by the Metropolitan Gas Referees, and does not warrant our going to further expense in the process in order to remove these infinitesimal atoms of sulphur from the gas about which so much has been written and about which so much time and money have been spent.

The distribution of gas is becoming a more difficult question as time goes on, the streets of our cities and large towns being so much occupied with drains, gas, water, electricity, telephone, and hydraulic power pipes, and tramways and conduits for similar purposes, that room cannot be found in them for the enlargement of existing gas-mains; and the question of high-pressure distributory mains will undoubtedly demand our attention in due course. The question of high-pressure distribution, or the distribution of a large volume of gas through a small pipe, is one which, I think, is applicable not only to large towns, but also to small ones. It often happens that a rather small gas-works is required to distribute its gas over a large straggling district; and to lay mains to carry the required volume at the normal pressure involves the concern in such heavy capital expenditure as to make the transaction commercially unsound. The old ideas with regard to low-pressure distribution should, I think, be finally abandoned. The theory that high pressure in the mains is synonymous with a high percentage of leakage, while it may be true in some cases, is only so in consequence of defective work in the laying of the pipes and services in the first instance. The very same pipes that we use for our gas distribution are employed for the distribution of water at a pressure of as many (and more) pounds per square inch as we use in tenths of an inch. It is, therefore, impossible to contend any longer that the gas can leak through these pipes if under a normal pressure of but a few pounds.

The question of the loss of illuminating power when the gas is subjected to such treatment has also proved to be unfounded, provided the substance is a gas and not a vapour. It therefore seems to me that, by distributing gas at a high pressure through a small pipe into outlying districts, many new consumers can be acquired; the low-pressure distributory system required for the particular locality being proportioned and laid in the usual way, while the leading main to this locality can be many times smaller in area, with a pressure of (say) 5 lbs., than would be required with the ordinary low-pressure system. The same principle may be applied to existing congested areas that require supplementing with an increased supply. The system of supplementing districts from existing trunk mains has been applied to a fairly large extent in the case of Edinburgh. The gasholders, situated as they are away from the present manufacturing stations, necessitated in the first instance trunk mains being led to them from the works; and in no less than five cases we have tapped these trunk mains—which are really the gasholder inlets and outlets—placing thereon a governor of the underground closed type, with its adjusting bell and fittings placed either in the base of a lamp-column or in a neighbouring cottage. From this point, the pressure is adjusted at various times in the evening during the excessive draw upon the mains in the locality, and a predetermined fixed minimum automatically assured. We have had no trouble whatever with the system. The governors are found to be perfectly reliable; and not the least gratifying feature is the large sum of money that has been saved, and the disturbance caused by the laying of additional trunk systems in populous districts avoided.

Another topic which has also occupied a considerable share of attention during the past year or so is that having reference to the organization of a Society which shall be truly representative of British gas practice. We are at the present time represented by three national Societies, and six District Associations. The principles upon which such a body should be constituted have been agreed upon by all parties; but there are difficulties in the way of bringing it about at the present time without apparently sacrificing many who have done well by the industry in other than a professional capacity. The importance of—in fact, we might say the absolute necessity for—the formation of a Society that can speak with authority and exercise its powers in the interests of the gas industry, is admitted by all. Had we have had such a society, some important representations might have been made to the powers that be, which would have prevented the imposition of a tax of 1s. per ton being put on our coke. Coke is not a mineral product mined for wealth; it is a residual product which we cannot help but produce. Therefore, being a residual product of an industry that is one of the necessities of existence, it should not be taxed—certainly not in the same ratio as though it still contained its volatile hydrocarbons.

It has often appeared to me that the gas industry has never shown itself to be sufficiently homogeneous to make its interests known as much as its national importance demands. There has often appeared to be a want of general interest taken in questions which do not directly affect the industry as a whole. We have never, therefore, been able to count upon the entire support of the whole interests when sectional interests only have been affected. For this reason, it seems to me that some automatic system of representation on the governing body of the National Association should be devised. Every District Association selects its best men from time to time to occupy the presidential chair. Why should not these men, who are truly representative of a locality where they are well known, and personally acquainted with the members of its District Association, also by right of such office form the Council of the National Association—for the time being holding office during their period of Vice-Presidency, as well

* See "JOURNAL," Vol. LXXVI., p. 350.

as during that of President, or, if found necessary, for three years, in order to preserve the continuity of policy in the management of the new Society.

Such a method of selecting the governing body of a National Society will not only ensure its being truly representative, it will also prevent the management falling into the hands of a *clique* which so often impairs the utility and destroys the harmony of many similar associations. I do not think that any reorganization of the District Associations need be undertaken in consequence of this suggested affiliation. The constitution of the new Society can be drawn strictly upon the lines which all parties appear to be agreed upon—that only men professionally engaged in gas-works management and construction shall be eligible for membership. It will therefore only be necessary that the men elected to the presidency in the District Associations should be subject to this qualification, with this exception—the management of the District Associations will proceed the same as now, some with and some without the association of men representing the trading, as distinct from the professional, side of the business.

Mr. W. Ewing (Greenock) said they had listened to a most interesting and able address from the President. They were greatly indebted to him for the valuable information he had given. When the address was printed and circulated among them, they would have great pleasure in studying the details of it. He asked them to give the President a hearty vote of thanks.

The President acknowledged the kind manner in which the members had responded to the motion.

Mr. A. Yuill (Alloa) read the following paper :—

GAS ENRICHMENT.

In placing this paper before you, I am uncertain whether I ought not to preface my remarks by offering you an apology for again entering the arena of gas enrichment, as this subject has been so often before you in years past. Should any apology be required, I can only excuse myself by stating that I had no alternative, as the fiat went forth from our worthy President that such a paper was expected from me. I anticipate that I share the feelings of the members of this Association in considering the subject before us as one worthy of study, and one that is of primary importance to us from a financial point of view, and also to our consumers from economical considerations.

The question may be asked: Is there any occasion for enriching gas from common coal? I am not prepared to debate this point meantime, but prefer leaving it to individual consideration. In the earlier stages of the gas industry, the question of enrichment was foreign to gas engineers, as most of the gas then made was from first-class cannel. Diluents were subsequently forced upon them for economical reasons and otherwise. We have now the antithesis of the first order of things; and the question as to the best and most economical modes of enriching gas made from common coal is ever before us. As you are aware, we have several well-tried methods of enrichment, such as cannel, shaly cannel, oil gas, carburine, and benzol. So much has been said in the past in praise of water gas, oil gas, and other modes of enrichment, that I shall confine my observations more particularly to enrichment by benzol.

As is well known, benzol is a distillate from light tar oils, the commercial products being classed as 30, 50, and 90 per cent., depending on the temperature of the distillation. The physical properties of these are as follows: A good sample of 90 per cent. benzol should yield 90 per cent. of its bulk at 100° C., and the residue should boil dry at 110° C.; and 50 per cent. benzol should yield 50 per cent. of its bulk at 100° C. An average of 90 per cent. benzol has the following percentage composition: Pure benzene, 75; pure toluene, 24; pure xylene, 1. Pure benzol boils at 80° C., and solidifies at 4° C.; while practically 10° Fahr. of frost has the tendency to crystallize it. Commercial benzol, on an average, contains about 0·4 per cent. of sulphur compounds per gallon. This will give, at one gallon per 10,000 cubic feet, about 2·48 grains per 100 cubic feet. Benzene is a purer form of commercial benzol, being practically free from impurities. The chemical formula for each is similar (C_6H_6). For the practical testing of benzol, I would advise students to consult the paper read at the last May meeting of the Manchester Section of the Society of Chemical Industry, by Mr. Wilfrid Irwin.*

In taking a retrospective view of the subject, one is reminded of the innumerable attempts made by investigators to recover benzol from coal gas. From experiments carried out some years ago by a Continental gas company, as noted by Lunge, it was found that a ton of coal gave 11,000 cubic feet of gas, containing 11·7 kilogrammes of benzol, &c. At the same time, 1 cwt. of tar was formed, which gave 0·5 kilogramme of benzol. Hence, according to this experiment, the gas from a ton of coal contained about 23 times more benzol than was found in the tar. This was done at a time when the prices for that commodity ruled much higher than they do at present, which formed a very legitimate stimulus for attempting to recover benzol from coal gas. These experiments, to my mind, modify the criticisms that are often made on the permanency of benzol as an enricher of coal gas. Information is often asked by some as to the permanence of gas enriched by this means. Were they to study the composition and the physical properties of ordinary coal gas, they would find practical proof of the tendency of gas to carry much more benzol vapour than that required to raise a 16-candle gas to one of 20 candles.

In considering the enriching value of benzol, one is confronted with the diverse results obtained from experiments made at various times and by different experimenters. This is not to be wondered at when it is stated that each was dealing with a different grade of gas, and that they all varied in their mode of application. Let us suppose an experimenter treating a gas having a low percentage of methane, and allowing the vapour of benzol to pass over it, or letting the gas pass over the benzol. Undoubtedly, he would get a low enriching value from the benzol used, more especially if he were testing the gas with an unsuitable burner. To get the best results, the test must be made with the flat-flame, and not an argand burner. It is now recognized that the higher the percentage of methane (CH_4) in coal gas, the higher becomes the absorption of benzol vapour. It has also been found that water gas with an ordinary percentage of H (50), CO (45), and CO_2 (5) would not carry benzol vapour to any extent, unless mixed with a proper proportion of coal gas. This mixture can then be enriched 4 candles without any condensation whatever. According to Professor Lewes, when benzol is mixed with water gas the illuminating power is found to be only 9 candles; but if this be mixed with 20 per cent. of 16-candle coal gas, the admixture will be found to have an illuminating power of more than 17 candles. The explanation given by Professor Lewes is that the methane in the coal gas brings out the illuminating value of the benzol in the water gas.

It may have been observed that the percentage of benzol in coal gas is always greatest when the heats are high. We know, too, that with high heats the percentage of methane is also increased—all pointing to the fact of the carrying power of methane. On making an examination of the tar from water-gas plant, it is found that it contains about four times more benzol than is generally found in coal tar, which also shows the low carrying power of the water-gas constituents for benzol vapour. The benzol derived from the tar from water-gas plant is free from sulphur impurities, and consequently lower in specific gravity. This quality of benzol is well suited for the enrichment of gas.

In the earlier stages of gas enrichment with benzol, some experimenters allowed the benzol vapour to pass direct into the gasholder, and were surprised to find that practically no enrichment had taken place. They were compensated to a certain extent by recovering some of the benzol in the syphon or drip-boxes. Need we be surprised at anyone condemning the enriching value of benzol after such an experience? There is generally a right and also a wrong way of trying to accomplish any object; and certainly the procedure as noted above ought to be classed in the latter category. To secure the full enriching value, the benzol must be vaporized at as high a temperature and pressure as possible—not less than 30 lbs. per square inch—so that the benzol vapour may atomize with the coal gas. Advantage is taken of the high temperature, in neutralizing the fall in temperature of the gas when benzol vapour is mixed with it, thereby preventing the sudden chill, which would have a tendency to precipitate the benzol before it had time to diffuse itself properly in the gas. According to Regnault's formula, the evaporation of 1 kilogramme of benzol at 20° C. absorbs 113·8 calories; and therefore the evaporation of the quantity of benzol necessary to raise 1000 cubic feet of gas 4 or 5 candles in illuminating power would absorb from 51 to 64 calories. Assuming that a cubic foot of ordinary coal gas contains 17·5 grains of benzol, this volume, theoretically, can further take up, at 0° C. 33·5 grains, at 20° C. 134 grains, and at 25° C. 175 grains—all pointing to the desirability of carburetting at the higher temperature.

In some works where the system of enriching with benzol has been adopted, it has been done by passing the benzol vapour into the gas as it leaves the governor. This method I would designate as very economical and convenient for the company or corporation, but not economical for the consumer. As we all know, the consumption varies every hour of the day; and, so far as I have been able to determine, we have no method whereby we can judge of the actual quantity of gas passing at any given time. Under these circumstances, it is impossible to have constancy in illuminating power.

In other works, there has been adopted a simpler method—namely, by allowing a small quantity of liquid (benzol) to find its way into the gas-main as it leaves the works. This method I would designate as crude and unscientific, and certainly not one that is worthy of being emulated, as the presence of benzol, when brought into contact with coal gas, has the tendency to reduce the temperature and prevent its absorption, as previously noted. From the experiments made in various quarters, it is now generally agreed that the best method of enriching with benzol is to add the enriching medium in the form of vapour to a proportionate quantity of gas—about 1-15th—and allow this to again mix with the remaining 14-15ths before the gas enters the holder; the admixture taking place after the gas has left the station meter. By this means a uniform gas is obtained, and to any degree of enrichment that may be required. I have worked on these lines from the time the process was first started at Alloa, and have not as yet discovered any trace of condensed benzol in any of the drip-boxes, either in the works or in the town, nor suffered any inconvenience by being unable to enrich to any extent required in any extremes of temperature. I have also experienced this—that when in the position of using a uniform coal, the coke does

* See "Journal," Vol. LXXVII., p. 1670.

not suffer by admixture with indifferent coke from other coals. The gas usually contains less sulphur when we are using splint coal, or coal of that class, than when using shale or shaly cannel. Consequently the gas is more easily purified; and the enrichment with benzol is effected with the greatest simplicity and precision. Carburetting with benzol has also had the effect of reducing or preventing the naphthalene difficulties so generally experienced by our friends in the South, though we in Scotland have been blessed with a minimum of trouble in this respect.

According to the experiments of Dr. Bunte and others, one gallon of 90 per cent. benzol is capable of enriching 24,500 cubic feet of ordinary coal gas by 1 candle, or 12,250 cubic feet by 2 candles; and so on in the same ratio. These results have been verified in my experience, and also in that of other experimenters. From the above data, anyone can work out for himself the comparison between enrichment with benzol or with cannel or shale. At one time, I contemplated giving you the comparison between oil gas and benzol for enrichment; but I found that, owing to the high price asked by manufacturers for shale oil at present, its use is prohibitive in comparison with benzol. Were they able to supply it at a more reasonable rate, I have no doubt that the process would again enter the arena as a competitor and as a means of enrichment. I have, however, given statistics showing the cost of manufacture from splint coal enriched with benzol, and splint coal enriched with cannel, from which may be noted the cost of enrichment per candle per 1000 cubic feet:—

Table showing Comparison of Enrichment with Cannel and with Benzol.

Cannel coal, taken at 28s. per ton, giving 11,500 cubic feet per ton.
Illuminating power of gas, 34 candles.
Splint coal, taken at 9s. 9d. per ton, giving 9500 cubic feet per ton.
Illuminating power of gas, 18 candles.
Benzol, taken at 8¾d. per gallon.

Description.	Quantity.	Rate.	Cost.	Gas Made.	Illuminating Power.	Cost per 1000 Cubic Ft.
	Tons. Cwt.	s. d.	£ s. d.	Cubic Ft.	Candles.	s. d.
Cannel coal .	1 10	28 0	2 2 0	17,250	34	2 5·21
Splint coal. .	4 0	9 9	1 19 0	38,000	18	1 0·31
Total . .	5 10	..	4 1 0	55,250	23·01 Average.	1 5·59

Cost to enrich from 18 to 23 candles, 5·38d., or 1·056d. per candle.

Description.	Quantity.	Rate.	Cost.	Gas Made.	Illuminating Power.	Cost per 1000 Cubic Ft.
	Tons. Cwt.	s. d.	£ s. d.	Cubic Ft.	Candles.	s. d.
Splint coal .	2 10½	9 9	1 4 9½	24,000	18	1 0·395
Benzol . . .	5 gallons.	0 8¾	0 3 7¼	..	..	0 1·822
Total . .	..	..	1 8 5¼	24,000	23 Average.	1 2·212

Cost to enrich from 18 to 23 candles, 1·822d., or 0·364d. per candle.

In giving the above comparisons, I have dealt only with materials and prices as affecting us locally. I am aware that some may be in a position to get cannel cheaper than the prices I have quoted. They may also require to pay more for splint coal, or they may be able to get a combination of first, second, and third class cannels to give them the illuminating power required at different rates. I give the comparison as it stands, and, consequently, each one will require to work out for himself his position as to costs. The crucial test in all cases is the cost per candle of enrichment.

After the discussion on this paper, a communication was read by Mr. R. W. B. Creeke, entitled "Some Notes on the Development of the Scrubber, with a Description of a New Type;" and this was followed by a short discussion. Pressure on our space compels us to hold over this portion of the proceedings until next week.

The Lecture.

In the course of the afternoon,

Professor Ivison Macadam, of Edinburgh, delivered the following lecture on "Light," illustrating his remarks by means of lantern slides:—

Mr. President and Gentlemen, the subject I have chosen for my lecture to you this day, while not of the usual "practical" character, has yet its practical side, for your business is the production of an article which shall, under certain conditions, produce light. Light may be derived from several sources, such as from the sun or other exterrestrial bodies, by the ignition of solids or gases, by phosphorescence, by luminous animals, phosphorescence of decaying animal matter, electricity, and during certain crystallizations. When a solid body can be raised to a sufficiently high temperature without decomposition, it emits light. Gases under ordinary conditions are more difficult to render incandescent; but if, after heating, a solid body is introduced into the highly-heated result of chemical union, brilliant incandescence may occur. This last fact is what is made use of in the production of many artificial lights, such as the Welsbach burner, the lime-light, &c.; but of these I propose to speak more a little later on.

Some mineral substances when gently heated give off a more or less feeble light, which, however, does not as a rule last long, but soon ceases, and cannot be again renewed until the original substance has been exposed either to the light of the sun or to some artificial light. This is well noticed in some specimens of native phosphorite or calcium phosphate, and in the variety of fluor spar known as chlorophane. The sea is sometimes, as we know, rendered beautifully luminous by swarms of minute forms of animal life; and the light emitted by the glowworm and firefly is also well known to us. Some forms of scolopendra actually leave a trail of light behind them. In these cases, oxygen seems to be necessary, as immersion in nitrogen or carbonic anhydride (carbonic acid) suspends the luminosity. Sea fish, especially whiting, herring, and mackerel, soon after death become luminous. This is best noticed before decomposition sets in, and gradually disappears as putrefaction progresses. If the fish are placed in a weak saline solution, the liquid becomes luminous; but on the addition of pure water, the light disappears. The same result is obtained when lime water, fermented liquids, acid, or alkaline liquids, or very strong saline solutions are added.

When vitreous arsenious oxide is dissolved in hot hydrochloric acid, and the solution allowed to crystallize, each crystal as it is formed gives off a small spark of light; and similar results are obtained from fused nitrate of soda, &c. To account for the phenomenon of light, let us suppose a perfectly elastic medium (ether), filling all space as well as the interstices of all material objects. This medium is susceptible of being thrown into undulations or vibrations, which cause light by impulses incessantly emanating from all luminous bodies. The light vibrations or waves would appear to have not only a forward tendency, but also a considerable sideward motion; and their contact with the eye appears to be somewhat similar to that of a hand drawn across the top of the head rather than by direct pressure.

Sound is similarly caused by vibrations, which, however, act on the air. The impulses are communicated by the motions of the particles of air to the ear. It is a well-known fact that sound cannot be produced in a vacuum, while light readily passes through one. The sound waves are comparatively slow in their rate of travel, which is 1120 feet per second through air (at 16° C.), 4708 feet per second through water, and 11,434 feet per second through an iron wire.

There are two methods by which waves may be propagated: (*a*) In highly elastic media, the particles of the medium may undergo alternate condensation and rarefaction in the *same* direction as that in which the wave is travelling, as occurs in the passage of sound through air; or (*b*) the motion may be at right angles to that in which the wave is advancing, as in the undulations which produce light. When light diverges from a luminous centre, its intensity diminishes as the square of the distance.

In the determination of the relative intensities of two lights which do not differ materially in colour, we make use of photometry. In this process, it is usual to employ a standard candle made from sperm wax, and with a wick constructed to burn 120 grains of sperm per hour. Of course, in working with such a candle, variations must occur, and the candles must be checked for consumption; for the standard is really the amount of light produced by the consumption of 120 grains of sperm wax. Sometimes, however, a regulation burner is employed, so regulated as to burn a definite amount of a gas of a definite composition, as in the pentane burner. This latter process is, no doubt, the most accurate; but as the apparatus is more costly, and the adjustments are more difficult to make, it has not been largely introduced into gas-works.

Without going into all the details of checks and regulation of apparatus, the process consists in placing a candle at one point, and the light to be tested at another (opposite) point. A screen is then moved back and forwards until a point is reached at which the shadows produced by the lights are equal. The distance from the screen to the lights is carefully measured. If the intensity of a light diminishes as the square of the distance, to find the relative value of the candle to the light tested we square the distance in each case from the light to the screen, and divide the product of the candle light into the gaslight. The result is the relative value in candle power of the light being tested.

In gas-testing, the result is generally given not only as the value in candles per 5 cubic feet of gas consumed, but also in its equivalent of grains of sperm wax per cubic foot of the gas. In coal analyses, these two results are also given; and, in addition, the right value of the gas from one ton of the coal in pounds of sperm. This latter figure is, to my mind, of much greater value than the other two; and in this I think you will agree with me, when you recollect the great differences in the number of cubic feet of gas, and in the quality of the gas, produced by variations in the temperature of the retorts, &c.

When a beam of light is transmitted through a prism, and the light is allowed to fall on a screen, we find that, instead of a beam of white light, we obtain what is known as a spectrum. This spectrum is made up of a series of bands, which grade into one another, and are coloured red, orange, yellow, green, blue, indigo, and violet. Of these, the red deviates least from its course, and is thus the least refrangible. The violet is the most refrangible. The light having been once decomposed into these colours by refraction, cannot be further decomposed; but by catching the

rays on a reversed prism, they can again be easily transformed into white light.

Objects which in themselves have no colour, when placed in white light absorb some of these rays and reflect others. Green objects, for instance, are those which absorb the red rays, and reflect the yellow and blue. The rays so absorbed are said to be complementary to those reflected, and are always those which, along with the reflected rays, would constitute white light.

Light of one tint is said to be homogeneous. Black bodies are those which absorb all colours; white bodies those which reflect all the rays. White light may also be decomposed by absorption, as is seen by passing a ray of light through a coloured medium. But the light so obtained is seldom so pure as that secured from a prism; and it can therefore be frequently further decomposed by the prism.

The prismatic analysis of light is not, however, altogether due to the refractive power of the body; it also depends on the dispersive power, which is independent of the refractive power. A carbon bisulphide or oil of cassia prism has much greater dispersive power than ordinary flint glass; thus a much longer spectrum can be obtained by their use.

When the spectrum obtained from solar light is examined, it is found to be crossed by innumerable black bands, known as Fraunhofer lines; and these are always obtained, irrespective of the composition of the prism. They are also shown in the spectrum of the light of the moon and planets. These black lines may be "cosmic" in origin; but cosmic lines, being most plentiful in the ultra-violet part of the spectrum, are not so readily noticeable. Some of the black lines are caused by the absorptive power of certain gases; for gases have also the power of absorbing colour. Each metallic substance, when sufficiently heated, emits light which, when passed through a prism, gives some distinct and characteristic bright lines. These lines are often produced by most minute proportions of the metals; and as they are absolutely characteristic, both in colour and in the position in the spectrum, they form a means for the detection and identification of traces of the metals much too minute to be otherwise detected. The position of the line or lines produced by any substance never varies in position. If, then, the solar spectrum is divided by a scale, and the divisions numbered, we can, on obtaining a spectrum, compare the lines produced with those previously shown to be given with any definite substance; and only if the result be exact will we accept the evidence of the presence of a certain body. Thus the yellow flame produced by sodium salts can be detected with so minute a proportion as 1-2,500,000th of a grain, cæsium to 1-170,000th of a grain, and the rubidium 1-33,000th of a grain. These two last metals were discovered with ease by Bunsen in the Durkheim mineral water residues; but before they could be prepared as salts, Bunsen evaporated no less than 40 tons of the water, and then the total amount of the mixed chlorides obtained was under 200 grains. Other metals have also been discovered by means of spectrum analysis—such as thallium in a Belgian pyrites, and indium in a zinc ore.

When a substance is heated, it is not only rendered luminous and gives off rays of a certain and definite refrangibility, but it has also the power of absorbing lines of the same refrangibility. For instance, if the strong yellow light of sodium is transmitted through the vapour of sodium, only a black line is obtained in the spectrum; and that black line is situated on the exact part of the spectrum where otherwise a strong yellow line would be obtained. The black lines in the solar spectrum have thus in many cases been shown to be due to the absorption of the metallic lines by the vapour of the same metal evidently in a high state of incandescence. You will therefore readily understand how easy it becomes, by means of spectrum analysis, to analyze the light of the sun, moon, or planets, and to tell with absolute certainty the composition of these celestial bodies. Gases also give definite spectra; and we are therefore able to say that the sun has an atmosphere, and that the chromosphere which surrounds the sun is composed largely, if not entirely, of gaseous hydrogen.

The rays of the spectrum can, however, be further analyzed; for, by cutting off all the yellow and violet rays, we find that the red rays still produce heat; by cutting off the red and violet rays, we leave the light giving yellow rays; and by removing the yellow and red rays, we leave the violet rays, which still possess chemical properties. Thus it is possible to boil water with rays from the red end of the spectrum, which are practically invisible, or to photograph with rays from the ultra-violet end of the spectrum, which are also invisible.

In the gas-works of this country, the product manufactured largely depends for its luminosity on the carbon it contains. In the ordinary batswing burner, there are the three well-known zones, two of which, the central and the middle, are readily visible, while the third, or outer zone, is practically invisible. The central or dark zone was at one time looked upon purely as a useless area; and attempts were made to, as far as possible, eradicate it. It was readily noticeable that increased pressure not only reduced the general luminosity of the gas, but also increased the dark area; and it was further recognized that gas could be readily drawn away from that area in an unchanged state. The zone was therefore, under the older theories, denominated the area of no combustion. Now, however, while acknowledging the effect of excessive pressures and the necessity for reducing them, the black area is looked upon as a useful and necessary part of the flame—as an oven, in which the gases, although not actually consumed, are to some extent at least broken up and prepared for the after-combustion. The luminous area owes its incandescence to highly heated carbon particles; while the outer area is non-luminous on account of the fact that no solid particles are present. If a solid, such as platinum wire, is introduced into this non-luminous area, light is emitted.

The non-luminous or bunsen flame—sometimes called the atmospheric burner—differs from the batswing in so far as it burns a mixture of air and gas. It appears to be a common idea that such burners are more economical because of the previous admixture with air; but this, of course, is absurd, as a given quantity of gas must always be required to furnish a certain amount of heat, and a cubic foot of gas will always need a definite amount of air to burn it, whether the air be mixed with the gas before it passes to the burner or not. In the bunsen burner, however, one effect is distinctly noticeable—that the previous admixture with air has almost, if not entirely, removed the luminous area of the batswing burner. I say "almost," because if the bunsen is burning correctly, the luminous area is represented by a slightly luminous tip. The violet outer and visible flame is the representative of the non-visible area of the batswing.

Another practical difference is noticeable. The heat generated by both the batswing and the bunsen is the same for any given quantity of gas; but in the batswing the heat is radiated in all directions by the solid incandescent particles in the luminous area, while as no solid particles are present in the bunsen, the heat ascends almost entirely in a column. The heat is therefore in the bunsen more readily applied to a vessel placed above the flame; while for oven heating the luminous flame, from the greater radiation of heat, is probably the best.

The introduction of a solid substance into a non-luminous flame is now regularly practised in the incandescent burners. Here the non-luminous flame impinges on a mantle composed of rare earths, such as cerium, didymium, lanthanum, &c. The earths are raised to a state of incandescence, and emit light. As the mantle components are already fully oxidized, no chemical change takes place in the mantle; and theoretically the incandescent substance is indestructible. Unfortunately, we have further to contend with the friable nature of the mantle components.

One point further regarding the Welsbach or incandescent gas-burner. The light is not obtained from the constituents of the gas, except indirectly from the heat of combustion. A perfectly non-luminous gas, or a very low candle-power gas, provided it in burning gives a sufficient amount of heat, should furnish just as good a light result as a high-quality gas. This statement is, for all intents and purposes, correct. The introduction of plant for the manufacture of Mond gas of low luminosity and low price, may therefore in time become an important factor in household lighting; and the time may yet come when you will turn out from your works a non-luminous water gas suitable, not only for light-giving with incandescent burners, but also for heating and for mechanical purposes. Such gas will, no doubt, be supplied at a very low cost; but it will be used in enormous quantity.

I have attempted, in the short time at my disposal, to give you a general outline of the subject—imperfect I admit it is—but I trust I have said sufficient to interest some of my audience who have not previously considered the subject of light, to set them thinking, and I hope to set them working, on a problem which is one of the most interesting I know.

The PRESIDENT said he had much pleasure in proposing a hearty vote of thanks to Professor Macadam for his very interesting lecture. It was a subject highly scientific in its character; but it had been laid before them in such a manner that they could all follow it most closely. He thought that, if justification were necessary for Professor Macadam being admitted an honorary member of the Association, he had shown it ten-fold that day. The subject was one in what he might term the higher classics of gas manufacture; but it was only by investigating such things that articles of utility like the Welsbach mantle were brought to their use. Many of them looked upon the Welsbach mantle as having been the salvation of the gas industry; and, as Professor Macadam had summarized his conclusions, he also seemed to think that the day of illuminating gas was done, and that they should supply a calorific gas—a gas from which heat could be derived, and by which a mantle could also be made highly luminous. No doubt, this was the tendency of the age; and many of them there might see it come about. With these few words, he would ask them to accord the Professor a hearty vote of thanks for his able lecture.

Professor MACADAM said he heard only when he came to the meeting that they had done him the kindness of electing him an honorary member of the Association. This he valued a very great deal, as they could quite understand. It meant, as he took it, that some of his friends in the Association were kindly disposed to him. But he took it to mean a little more, and although he had no right, and no desire, to enter into family matters there, they could quite readily understand what it was for him to take the place of his father in connection with the Association. He knew that his father always looked forward to their meetings—though he was latterly not able to be present regularly—as one of the most pleasant of the various gatherings he had to attend in the twelve months. He knew that he had received extreme kindness from the Association, and his family had received extreme kindness from them since his father's death; and he looked upon the honour they had done him more as a token of their regard for

his father than as having anything to do with himself. At the same time, he could assure them that he had already experienced much kindness from the gas managers in another part of the country—viz., in the North of Ireland; and he never felt happy if a season passed without his being able to visit the North of Ireland. Many of those present had met him there, and seen the happy hours that were spent. He could assure them it would not be his fault if, in the North British Association, they had not the same experience, and if they did not keep up the same cordial relationship as had existed between him and his family in the past.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT intimated that the ballot had resulted in the election of the following as office-bearers for the ensuing year:—

President:—Mr. JOHN WILSON, of Tradeston, Glasgow.

Vice-Presidents:—Mr. T. LIGHBODY, of Renfrew; and Mr. D. ROBERTSON, of Dunoon.

Hon. Secretary and Treasurer:—Mr. R. S. CARLOW, of Arbroath.

New Members of Committee:—Mr. J. CARMICHAEL, of Barrhead; Mr. W. FAIRWEATHER, of Kilmarnock; Mr. J. M'GILCHRIST, of Dumbarton; and Mr. W. B. M'LUSKY, of Perth.

Auditor:—Mr. R. B. MAIN, of Glasgow.

NEXT PLACE OF MEETING.

It was resolved to hold the meeting in 1902 in Perth.

VOTES OF THANKS.

The PRESIDENT said he had now to propose that a hearty vote of thanks be accorded to the authors of the papers. The compilation and preparation of a paper for their annual meetings was not by any means a small task; and he thought the papers had shown a considerable amount of character, and entailed a certain amount of research in their compilation. He was sure it would be their wish to accord a vote of thanks to the authors.

This was agreed to.

The PRESIDENT said he had also to propose that a hearty vote of thanks be accorded to the Senate of Glasgow University for their kindness in permitting them to meet there that day. He was sure it was a privilege which they fully appreciated. It was a splendid hall for the purpose of their meeting; and the whole precincts, and the associations of the place, were such as to have lent a charm to this, their first meeting of the new century.

The motion was carried.

The PRESIDENT said he had one more duty to perform, and one which would meet with their hearty approval. It was a vote of thanks to the Secretary, Mr. Carlow. It was one thing to be President; but it was nice for the President to have another man doing all the work. This was generally what a Secretary had to do. He was quite sure that only those who had passed the presidential chair could properly appreciate the enormous amount of labour and anxiety which devolved upon the Secretary of the Association—not in the work during the year only, but also in the preparation for the annual meetings.

Mr. CARLOW said he thanked them sincerely for the very kind way in which the President had proposed the vote of thanks to him, and for the manner in which it had been responded to. As he had often said at meetings before, it was a labour of love to him; and he certainly took a great deal of pride and pleasure in it. As long as he was their Secretary, nothing should be wanting on his part to make the meetings of the Association a success, both practically and financially.

PRESENTATION OF THE PRESIDENT'S MEDAL.

Mr. EWING said they would agree with him that they were greatly indebted to Mr. Herring for his excellent services as President. His address that day would go down as a record in connection with the Association; and he was sure his name would always be honourably remembered in regard to the interest he had taken in the Association. On behalf of the Association, he had much pleasure in presenting him with the President's medal as a memento of the occasion; and he wished that he might have long life, health, and happiness to wear it.

The PRESIDENT said he must first of all thank Mr. Ewing for the kind remarks respecting himself he had made on behalf of the members. He felt it to be a great privilege to have served as President of the Association during the past year, and a privilege and a pleasure to preside at their meeting there that day. The beautiful little memento which had just been presented to him, he received gratefully; and he assured them that he should prize it for the rest of his life.

This concluded the business of the meeting.

On the termination of the meeting, the members found their way into the International Exhibition; and, being joined by friends, including many ladies, they there, to the number of over 150, sat down to dinner in the Grosvenor Restaurant. Mr. Herring again presided. One or two toasts were proposed and acknowledged with commendable brevity; the principal one, after that of "The King," being "Kindred Associations," by the Chairman, and responded to by Mr. J. C. Adamson, of Airdrie, as representing the Waverley Association, who also possesses the distinction of being one of the original members of the North British Association. The remainder of the evening was spent in viewing the Exhibition.

On Friday, the annual excursion was held. A large and happy party of ladies and gentlemen enjoyed a sail on Loch Lomond; returning to Glasgow by rail in time to allow those who cared to do so to pay another visit to the Exhibition.

SOCIETY OF CHEMICAL INDUSTRY.

Annual Meeting in Glasgow.

The Annual General Meeting of the Society was held in the Chemical Lecture Theatre of the Glasgow University last Wednesday—Mr. J. W. SWAN, F.R.S., in the chair.

Lord Provost CHISHOLM having, in a few appropriate remarks, welcomed the members to the city,

The GENERAL SECRETARY (Mr. C. G. Cresswell) read the annual report. It set forth that the number of members on the register is now 3632, compared with 3459 at the last annual meeting. During the year 332 new members had been elected, compared with 305 in the previous year. The loss had been 159, against 158 before. There had been 34 deaths, compared with 36 in 1899. One of the deceased members was Mr. C. F. Claus, and another Dr. Stevenson Macadam, both of whom were known by repute to our readers. During the session, 80 original papers, together with discussions thereon, had appeared in the Society's "Journal," compared with 81 before.

The PRESIDENT then delivered his Inaugural Address. Taking as his subject the electro-chemical industry, he traced the progress of this new branch of applied science from the early laboratory researches of Davy and Faraday down to the position occupied at the present time. Details were given, so far as it has been possible to obtain them, of the power at present utilized, and the products made, in the 150 works using electricity for chemical and metallurgical purposes in Europe. The methods employed in several branches of manufacture were also described, and the chemical and metallurgical products which are now the result of electrolytic or electro-thermal operations dealt with. In several instances Mr. Swan stated that the new methods of manufacture had already supplanted the old ones; while in other cases there was keen competition between the chemical and electrolytic processes. Turning from a consideration of the past growth and present development to the future, the President pointed out that the United Kingdom is severely handicapped, as regards these new developments, by her lack of water power. In spite of this, however, many of the new electro-chemical industries could, he said, be carried on profitably with steam power. The improvements in the steam-engine and gas-engine which were occurring every year would still further advance the position of those countries possessing extensive and easily worked coalfields, but little or no water power. The utilization of the waste gases of blast-furnaces in large gas-engines for the generation of electrical energy would also become a realized fact, and would supply large quantities of cheap power for the industries under discussion. While, therefore, fully admitting that the position of the staple chemical and allied industries in this country had been undermined to some extent by the rapid growth of electro-chemical industries abroad, and that protective tariffs were being employed to shut out British products, the President expressed the belief that the future might be faced with some degree of confidence and hope. The increasing strain of foreign competition, however, made it imperative that our manufacturers should give still greater attention to science, and also to the results of original research. An essential condition of future progress was that those at the head of our manufacturing industries should possess a science training of university standard. The elementary instruction in science of the rank and file of the workers was no substitute for this, and, in itself, was of no great value. The President closed his address with the following impressive words: "The advances in knowledge, and the consequent revolutionary changes that have taken place in almost every branch of chemical industry during the last hundred years, are probably not greater than those further changes that will be seen at the end of the present century; for change brought about by scientific discovery grows ever swifter and more sweeping. But change is in the natural order of things; and so long as it is in harmony with progress and improvement, it is to be welcomed. It cannot be resisted. We must prepare to meet it, and we had better meet it on the threshold. But to benefit by it, and to take complete advantage of it, demands the fullest measure of assistance that education, energy, and enterprise can unitedly give. . . . If, as we enter the darkness of the future, we firmly grasp the guiding hand of Science, and, with full faith in her leading, follow her with an alert step, we may go on with a full assurance that we shall be led in the way of prosperity."

On the motion of Mr. IVAN LEVINSTEIN (the new President), seconded by Sir R. PULLAR, a cordial vote of thanks was passed to the President for his address.

It was decided to hold the next meeting in Liverpool.

A vote of thanks was accorded to the University authorities for the use of their buildings, and the proceedings closed.

The afternoon was devoted to the Exhibition; and in the evening a large company gathered in the Municipal Buildings at a *conversazione* given by the Corporation.

On Thursday a number of works were inspected, and in the evening the annual dinner was held in the Windsor Hotel. An excursion down the Clyde on Friday brought the proceedings to a close.

DENAPHTHALIZER FOR ILLUMINATING GAS.

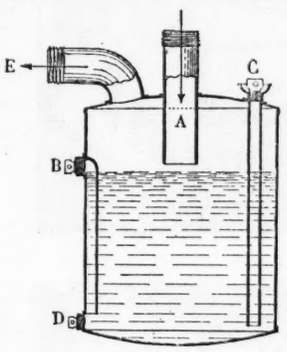
By L. Breittmayer, of Bordeaux.

[A Paper read at the Annual Meeting of the Societe Technique.]

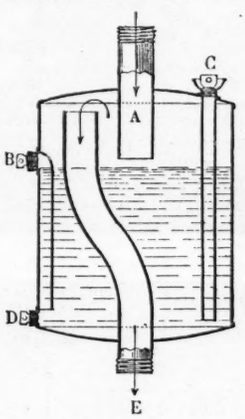
Naphthalene causes, by its crystalline deposits, obstructions which are often rapid and frequent, in pipes and apparatus in which gas circulates. The apparatus I have the honour to present to the congress is designed to prevent such deposits and obstructions from occurring. They can be prevented in two ways: (1) By bringing the gas into contact with non-volatile hydrocarbons, at the ordinary temperature, which dissolve the naphthalene vapours contained in the gas. (2) By introducing into the gas very volatile hydrocarbon vapours, which by their presence prevent the formation of deposits, and even remove crystallizations already existing by, so to speak, dissolving them. The second of these processes seems the most reasonable, because it does not deprive the gas of elements which contribute to improve its illuminating power. It may, it is true, cause some slight inconveniences—for example, make the flame a little smoky when there is an excess of hydrocarbon vapour.

In order that these processes may be efficacious, it is not enough if the gas has merely been in contact with the liquid. When this contact has not been intimate, it can be readily understood that in the first case naphthalene vapours which have escaped the action of the liquid may be deposited by crystallizing on the sides of the gas-pipes or apparatus; and that in the second case, the mixture of gas and vapours not being perfect, veins of non-carburetted gas, less dense than those of the carburetted gas, may circulate without mixing, and produce deposits. The condition of contact or intimate mixing seemed to me to be essential; and this I have endeavoured to realize.

As will be seen from the accompanying illustrations, the apparatus consists essentially of a pipe A, connected by a branch



Type A.—Arrangement for a Pipe.



Type B.—Arrangement for a Meter.

with the gas-inlet pipe running into a closed vessel of any form and capacity. Shape has no influence on the effect produced, which is instantaneous. Capacity only affects the quantity of liquid contained in the apparatus, and consequently the time during which the latter can work without any renewal of the liquid. The pipe ends a little above the level of the liquid; the level being regulated by a plug B, screwed into a lateral orifice. Two openings C and D, also closed by screw-plugs, are provided for introducing the liquid and clearing out the vessel containing it. In order to prevent accidents which might cause escape of gas due to neglect to shut one of the plugs B C, their orifices are furnished with plunger tubes. Finally, a pipe E, running from the upper or lower part of the vessel, is connected with the plant to be supplied.

The principle applied in working the apparatus is to make the current of gas reach the surface of the liquid vertically or obliquely, without bubbling, in such a way that it is spread over the surface—all parts, without exception, being in contact therewith. For large apparatus, the principal stream of gas is divided into a series of small streams, so as to assure this intimate contact. This mode of action of the gas on the liquid seemed to me to present the following advantages:—

1.—The stream of gas impinging on the liquid produces a depression, the extent of which increases with its velocity. The surface of intimate contact on this depression varies, therefore, proportionately with the delivery of the gas.

2.—The movement imparted to the liquid by the gaseous stream, constantly renews the former on contact with the new gas entering the apparatus; thus making the effects more rapid and certain.

3.—The naphthalene crystals which are already formed in the pipe preceding the apparatus, and which may be entrained by the gaseous current, are projected into the liquid, and arrested in their passage.

4.—As the gas does not bubble in the liquid, the working of the apparatus does not cause any perceptible decrease of pressure.

MODERNIZING THE CARBONIZING PLANT AT THE CHESTER GAS-WORKS.

The Roodee works of the Chester Gas Company are at any time interesting to the gas engineering visitor. They are pleasantly situated; and their position in relation to the city is all that could be desired from the gas suppliers' point of view. The site is on the bank of the River Dee; the London and North-Western line borders, at an elevation, one side of the works, and the far-seeing engineer would say that the year is not very distant when the Directors will find that their business has grown to such dimensions that the necessary capital expenditure for the construction of a siding would not be an unprofitable investment. We can imagine that a similar thought has already frequently crossed the busy mind of the Company's Engineer, Mr. John C. Belton. The only objection to the site, from the constructional point of view, is perhaps the nature of the subsoil; but even about that, as the works themselves prove, there are no insuperable difficulties. The works, which were built in 1880-81 under the direction of the then Engineer and Secretary (Mr. Fletcher W. Stevenson), are admirably planned. They are spacious, and the ample room between the plant is helpful in their economical conduct. To one accustomed to visiting gas-works, a noticeable feature is the cleanliness and order which abound throughout the place, even at the present time when work of enlargement is in progress; and upon this we cannot resist congratulating Mr. Belton.

The work which is now being carried out is of an extremely interesting character—in short, it is the conversion of the retort-house from the old-fashioned practice in carbonization to the methods which experience has proved to be of the best, and which will, on the same ground-space, furnish means for an increased production of gas to the extent of 50 per cent. The expenditure which has been incurred to secure this has been a wise one; and we have no hesitation in saying that it will bring in its train that economy and improvement in working which are the aim and object of all such changes. Besides this, the conditions under which the men will in future perform their labour will be of a vastly superior order than heretofore. About the conversion of the plant of a retort-house from old to new systems, there is nothing particularly novel; but it will be seen that the work which we shall presently describe possesses features and lessons worthy of observation and record.

First of all, let us call attention to the necessity which demanded the alterations. In 1880, when a commencement was made with the erection of the new works, the annual production of gas was 112,644,000 cubic feet; and the maximum daily consumption was 685,000 cubic feet. The works were only designed for a maximum daily output of a million cubic feet; but by 1898-9—the year in which Mr. Belton entered on the management—the demands upon them reached 1,104,000 cubic feet a day. Thus there was an imperative necessity for increased producing capacity; and it must be that at times during the last two winters, the Engineer has found his position a somewhat tense and anxious one. Mr. Belton set to work to consider how best, under the circumstances, this condition of things could be remedied. The then existing carbonizing plant was constructed on the direct-fired system. There were sixteen through arches of seven retorts, or 224 mouthpieces. The retorts were ovals, 8 ft. 9 in. long inside by 21 in. by 15 in., and were capable of yielding about 5500 cubic feet per mouthpiece when in good condition. It will be of interest to bear these figures in mind in order to compare them with those showing the capability of the new plant.

Previous to 1898, a few of the settings had been converted into sixes on the shallow regenerator principle; but the nature of the subsoil offered extreme difficulties to their construction and working. With this experience before him, Mr. Belton, after a careful study of the position, came to the conclusion that it would be advisable to reconstruct the whole of the interior of the retort-house, and put in regenerators on the stage-floor plan, with coal-handling plant and stoking machinery. To this scheme, the inadequacy of the height of the house was a barrier; but the advantages to be gained were sufficient to justify him in boldly recommending a structural change in the house of a rather big order—viz., the raising of the walls of the house, and the construction of a complete new roof. The old roof, as will be seen by the first illustration, was merely a double-gabled wooden one; but the walls and foundations were of substantial construction. The proposals found favour with the Directors; and without delay or competition, they placed the entire contract in the hands of West's Gas Improvement Company. Such confidence is something of which the firm may be proud. The plans and specifications were prepared by Mr. Belton; and, under his supervision, the contractors carried out the first part of the work last year—viz., the removal of the old roof, the raising of the walls, and the construction of the new roof, as depicted in the second photographic reproduction.

The arrangements for executing the work required careful thought and manipulation, as the old roof had to be taken down and the new one erected over the heads of the workmen, while the ordinary work of gas making was proceeding. Then it was also necessary to scheme out a plan for enabling the whole of the retort-settings to be taken down and the new ones erected during a single season. In the end, it was determined to commence pulling down half the old retort-benches as soon as the winter

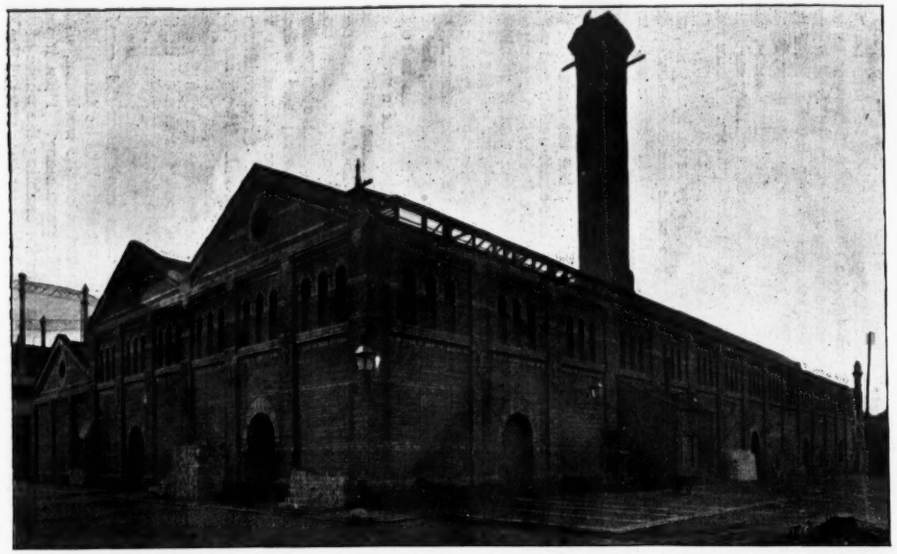


FIG. 1.—EXTERIOR VIEW OF RETORT-HOUSE BEFORE ALTERATIONS WERE MADE.

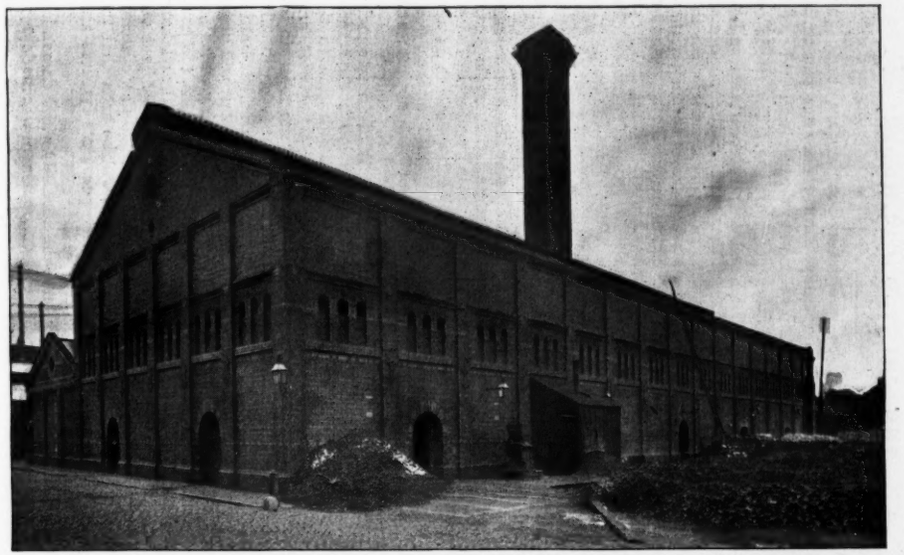


FIG. 2.—EXTERIOR VIEW OF HOUSE WITH THE RAISED WALLS AND NEW ROOF.

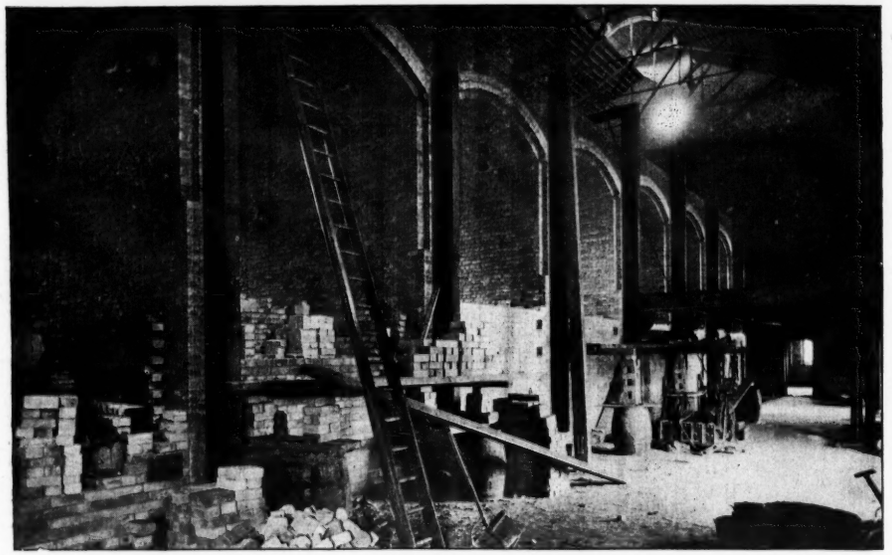


FIG. 3.—MAIN ARCHES AND WEST'S REGENERATIVE FURNACES IN COURSE OF CONSTRUCTION.

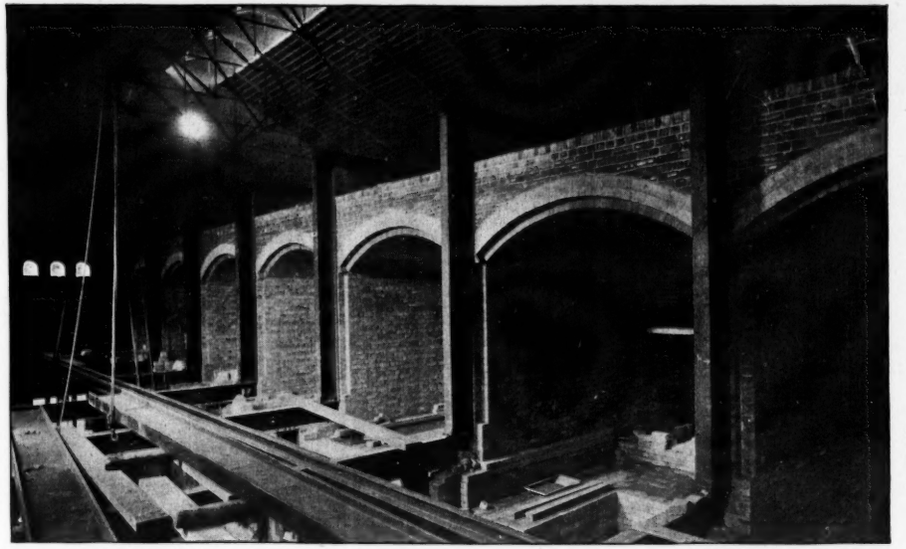


FIG. 4.—MAIN ARCHES AND STAGE-FLOOR GIRDERS IN COURSE OF ERECTION.

work was over, and to build in their place the new regenerator settings, with the stoking machinery, &c., as quickly as possible. Then directly the first section was ready for producing gas, the proposal was to start it, and at once attack the work of dismantling the second half, and erecting the remainder of the new plant in its place, in readiness for the coming winter. To carry out this arrangement, required very special and prompt attention and supervision on the part of both Engineer and Contractors, in order to meet these exigent and important conditions. So far, the contractors have completed their work up to the point when part of the first half of the new benches are undergoing the process of heating up, and are perhaps by this time about ready for the work of carbonizing to be commenced in them. As a matter of fact, it will be seen elsewhere [p. 293] that this section was formally inaugurated by the Chairman (Mr. John Gamon) last Thursday. The material for the second half of the work has already been delivered.

But to return to the structural alterations to the retort-house. The walls have been raised from 23 feet to 31 feet to the wall-plate; and, in every particular, the design is similar to the old part of the structure. The new roof is a forged iron, single-span, trussed one, with slates tied on with copper wire. It has a span of 60 feet, is 185 feet long, and has two dormers on the south-west side to accommodate the heads of the elevators. There are 22 wrought-iron trussed roof principals, each being 61 ft. 6 in. span, and bolted to cast-iron shoes secured to rest-stones on the side walls of the building. The rafters are formed of 5 in. by 4 in. by $\frac{5}{8}$ in. T iron; king rods, $1\frac{1}{4}$ in. round iron; foot rods, $1\frac{5}{8}$ in. round iron; suspension rods, $1\frac{1}{4}$ in. round iron; struts, 3 in. by 3 in. by $\frac{1}{2}$ in. T iron; and purlins, $1\frac{3}{4}$ in. by $1\frac{3}{4}$ in. by $\frac{5}{16}$ in. angle-iron.

The new retort-benches contain fourteen through arches of eight retorts, or 224 mouthpieces. The retorts are of D section, 10 ft. long inside, by 22 in. by 16 in., and are capable of producing 8000 to 8500 cubic feet per mouthpiece a day—thus, as already said, providing on the same area an increased production of 50 per cent. The whole of the ironwork fittings is new. The tar take-off valves are 6-inch ones. The hydraulic main is in separate lengths, and is fitted with West's weir-valves connecting to a 12-inch receiving-main, which again connects to a 2 ft. by 1 ft. 6 in. rectangular foul main running round the house, and which forms a primary condenser. The regenerator furnaces, on West's patent system, are all on the south-west side of the benches, and on the ground floor. There is a furnace to each through arch; but the retorts themselves are not through in the ordinary sense, as they are divided in the middle. The object of so arranging the furnaces was to have less coke for removal through the arch-way of the chimney, which is in the centre of the house. Down the front of the settings below a good channel is provided to carry off the water from the ash-pans. The structural ironwork bracing the retort-beds together is of a massive and strong description. This is found to be absolutely necessary in connection with retorts heated with regenerator furnaces, so as to prevent any undue expansion or disorganization of the retorts in the settings. The third photograph shows the main arches and the regenerator furnaces in course of construction.

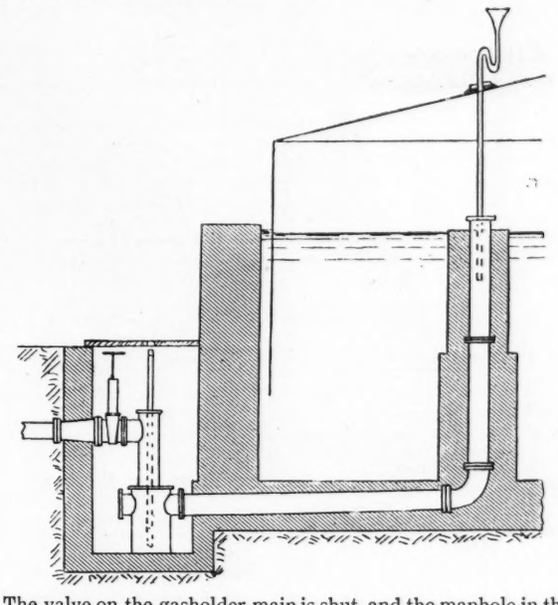
The stage floor is 10 feet above the ground level. It is built on columns and steel girders, with cement concrete arches, paved with rough blue bricks, set on edge. The advantage of this kind of floor is that it is cooler for the workmen than iron plates, and gives a better grip for their feet. The stage floor gives a light and airy cellar, which is a great consideration in the work of a retort-house—adding as it does to the comfort and the improvement of the working of the men. Speaking of this, reminds us that on a visit last week, the extremely good provision for the ventilation of the buildings was particularly noticeable. The manual charging and drawing machines work on the stage floor; and on girders spanning the house above are the storage hoppers (each of 7 tons capacity) and cross conveyors. These are fed from coal-breakers and elevators in the adjoining coal-store. The coal breaking and elevating plant so far erected is driven by one of the National gas-engines of 8-horse power (10 brake horse), situated in a dust-proof apartment specially constructed in the coal-stores. Similar provision will be made for operating the plant in the other half of the house as soon as completed. The whole of the new plant—settings, regenerators, and machinery—is of the West type. The fourth illustration is from a photograph of the main arches and stage-floor girders in course of erection.

We must compliment the Company, Mr. Belton, and the West Gas Improvement Company on the splendid character of the completed work, which has been carried out, owing to the peculiar circumstances of the case, under conditions not the most advantageous. However, the work has been satisfactorily executed; and its solid and well-finished appearance gives an assurance of a long life of profitable usefulness.

Apart from the improvements, which really form the subject of this article, Mr. Belton has recently put in a Meldrum furnace to one of the boilers; and its performance, being satisfactory, it is contemplated adapting the same type of furnace to the other boilers on the works. Another addition is one of Broadbent and Sons' centrifugal hydro-extractors for drying sulphate as it comes off the table. It deals with the whole make of 30 cwt. per day; the charges being about $1\frac{1}{2}$ cwt. It is a simple arrangement; and the sulphate is quickly ready for bagging without any further handling. A demonstration of its work was convincing as to its efficiency.

REMOVAL OF NAPHTHALENE FROM GAS-HOLDER CONNECTIONS.

Herr Wahl, of Güstrow, has described in a recent number of the "Journal für Gasbeleuchtung" a method of removing naphthalene obstructions from gasholder connections. He refers to the method devised by Herr Deegen, of which a description was given in the "JOURNAL" for March 19 last (p. 757), and also to the extended use of solvent naphtha or xylene for taking up deposits of naphthalene. But the following method of applying solvent naphtha which has been adopted by Herr Wahl for removing some obstinate obstructions has the advantage of requiring only a relatively small quantity of the solvent, while he has found that it gives excellent results.



The valve on the gasholder main is shut, and the manhole in the crown of the bell over the mouth of the main is bored for a 1-inch plug. Through this hole is inserted a half-inch pipe, the upper part of which is bent to form a water-seal, as shown in the illustration. Then through this half-inch pipe, the mouth of which is provided with a funnel, water is poured into the main until it is filled to half its height, or as high as the naphthalene deposit occurs. Then from 4 to 5 gallons of solvent naphtha are poured in, and the water is slowly pumped out at the syphon, so that the liquid gradually falls in the main. The consequence is that the solvent, which forms a layer on the top of the water, is forced to act on the whole of the interior surface of the main, both where the latter is upright and where it is nearly horizontal. The time during which it acts on the surface is determined by the rate of pumping, and thus may be made sufficiently long to complete the solution of the naphthalene. When the solvent has reached the elbow, the rate of pumping is diminished in order to give the solvent longer time to act on the greater horizontal section of the pipe which then becomes exposed to it.

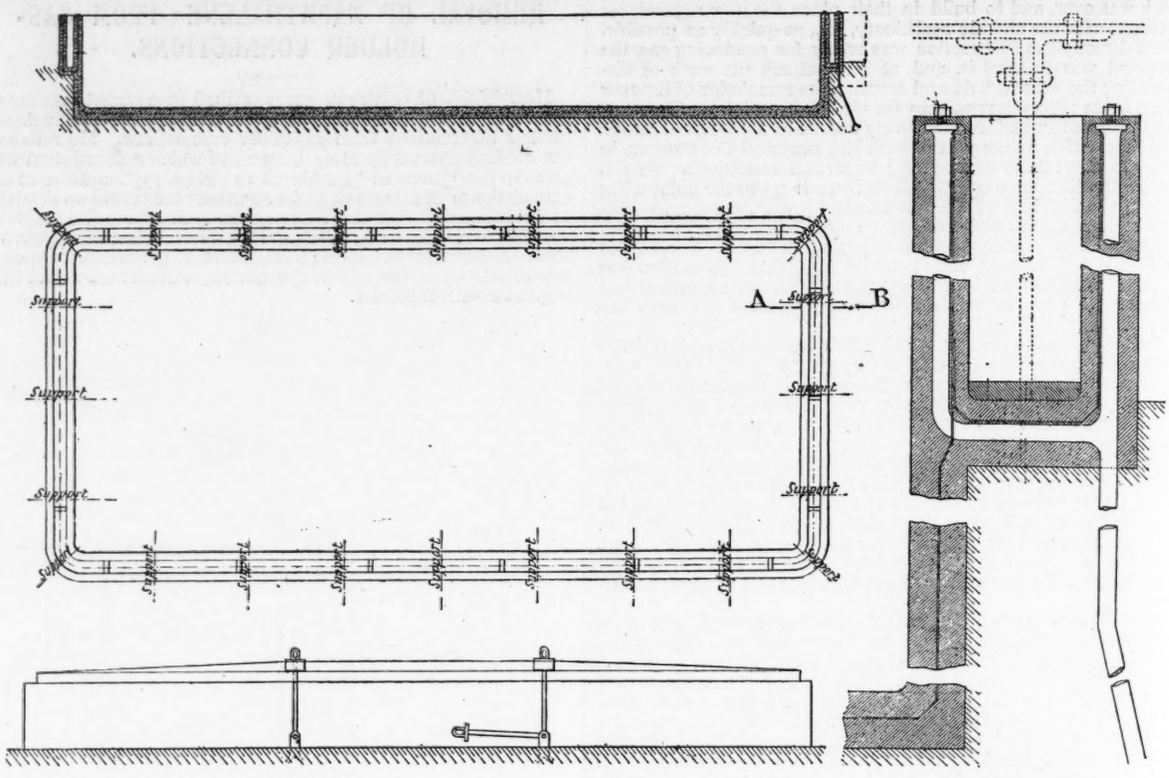
Herr Wahl points out that by this method of treatment the whole of the inner surface of the pipe is freed from naphthalene, which is ultimately completely removed from the main as a pulpy solution through the pump. On the other hand, if the solvent were directly applied, only the less dense parts of the naphthalene deposit would be removed at once, and the liquid would run down the furrows made in it, while a much greater quantity of solvent would have to be employed.

EXPANDED METAL FOR THE CONSTRUCTION OF PURIFIER-BOXES.

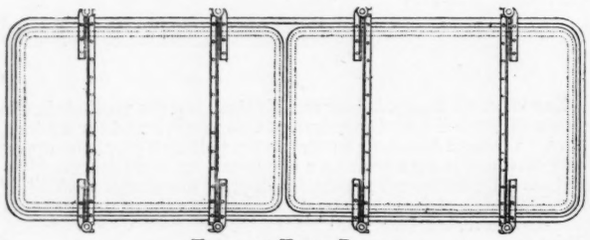
By P. BACHELAY, of Toulon.

[A Paper read at the Annual Meeting of the Societe Technique.]

This note has no other aim, and certainly no other pretension, than to make a suggestion which is, I believe, calculated to render some service to those of us who have to erect, or to extend, their purifier-houses. Several of our colleagues—and they not the least well known—have before now spoken of constructing purifier-boxes in masonry (Servier in 1876, De Lachomette in 1878, and Foucart in 1879), and of the building of gasholder tanks in metal and cement (Monier in 1886, and Bouron in 1893). It is the application of this latter system of construction to purifier-boxes to which I wish to refer for a moment to-day, because I do not think that it has yet been used for this particular purpose, and it seems to overcome altogether the objections raised to the adoption of boxes in ordinary masonry of bricks and cement.



SECTION, PLAN, AND ELEVATION OF PURIFIER. SECTION AT A B.



TYPE OF TWIN BOXES.

After the signing of the new agreement between the town of Toulon and the Société d'Eclairage, prolonging our right of existence for 21 years, and leaving 40 years before us, during which we shall have to arrange for ensuring the manufacture and supply of gas to both the Municipality and private consumers, my Directors wished me to prepare a general scheme, but only to be carried out in successive parts, proportionately to the increase of consumption. Now, our works at Toulon, which a good many of you have seen, and which others will have, I hope, the opportunity of one day visiting, are established within the area of military regulations. . . . There is a fair extent of land belonging to the works, which may only be utilized, under the kindly eye of the *Génie Militaire*, for depôts of materials, and coal and coke; and, further, these stores must not be more than 2 metres (6 ft. 6¾ in.) above the ground. But the erection of the smallest building is not to be dreamt of. Dame Government is there, and is wide awake. However, the erection of gasholders, which are movable plant, is fortunately allowed. Excuse this little pleasantry in the sphere of military things, which was necessary to explain to you why I had to decide upon using, for my purifier-house, an old coal-shed, just as it was, of ample area, but the spacing between the columns of which limited the size to be given to the boxes.

The utilizing of the various types of cast-iron plates for purifiers, shown in the catalogues of foundries in France and Navarre, did not seem likely to give satisfaction. One design of box did not leave the required space between it and the one adjacent, the middle of the space being unavoidably marked as the position of a column; another design of box left too much space, and so a doubly valuable area was lost—as purifying surface, and also covered surface, so to speak, were unemployed. It seemed that I was reduced to making special and costly patterns, when I had the idea of adopting cement, strengthened by expanded metal, which not only allowed me to give the most arbitrary dimensions to the boxes, but also to agree exactly with the space which it was possible to allot them. The accompanying drawings show the realization of this idea, which was carried out, after mutual examination, by the firm of Paufique Bros., of Lyons.

Boxes made in this way do not take up, on the horizontal plane, more surface than if they were formed by joining together cast-iron plates; the vertical sides are only 0·06 m. (2⅜ inch) thick, the same width as the flanges of metal plates. They are monolithic, very strong, and absolutely impervious. The edges of the lutes are protected by reversed ⊔ irons, easily saved from contact with the gas and purifying material by coats of tar. The jointing of the inlet and outlet pipes to the bottom is easily effected. The brick-work supporting the box is the same as if it were intended to carry a cast-iron one. The fastening of the cover is done by means of ties fixed in the ground. These boxes can be built very quickly. I may also add that, in case of accident, it is easier to do again a portion of the rendering over a crack in this special material, than to make a cement covering adhere to cast iron. Finally, there is another argument which appeals in favour of the system—it costs two-fifths less than the cast-iron box, which is not, I think, to be despised at a time when there are so many unpleasant surprises in the price of iron.

I will finish this too long note by merely adding that this system lends itself to the construction of boxes, called "twin boxes" (one of the four lutes being common to another box), which have the advantage of increasing the purifying service for a given covered area.

OPEN AND COVERED SERVICE RESERVOIRS.

The second paper read at the recent meeting of the British Association of Water-Works Engineers was by Mr. W. INGHAM, Assoc.M.Inst.C.E., the Water Engineer of Torquay. It dealt with the "Design, Construction, and Cost of Open and Covered Reservoirs." The collection of the material for the paper had involved a great deal of time; and the author adopted a method of dealing with it which commended itself to the assembled members. In fact, there is not the slightest doubt that, from the technical point of view, the paper was the feature of the meeting. The following are only extracts from the communication, which was freely illustrated.

The chief points to be considered in the designing of a reservoir were first set forth, as follows: (1) The greatest daily variation in the supply. (2) The length of time necessary to repair any defect either in the trunk main, pumping-engine, or other machinery between the storage reservoir or well and the service reservoir. (3) The maximum requirements in case of fire, or of the bursting of water-pipes, as in 1895, due to frost. (4) Utilizing the reservoir to equalize the variation due to intermittent pumping.

The variation in the daily consumption is by no means the same in different towns, or even in different districts of the same town. As an instance of this, attention is drawn by the author to a reservoir where the greatest hourly demand is 6000 gallons between 11 and 12 a.m., or three times as great as the least demand of 2000 gallons, between 1 and 4 a.m.

Where there is only a single main from the storage to the service reservoir, the latter should be large enough to supply the district for from three to four days—if in duplicate, from one to

two days' supply will be found sufficient; but the capacity of the reservoir must depend somewhat on the length and accessibility of the main. If the distance from the storage to the service reservoir be short, it may be more economical to lay a second main rather than to build a larger service reservoir.

For pumping schemes where the machinery is duplicated, a two days' supply is generally sufficient. If the water is delivered to the town direct from the trunk mains, a larger pipe will be required, as it will have to discharge at a rate sufficient to meet the greatest demand; but with a service reservoir this will be avoided. If the district supplied is very hilly, it can be worked in zones by separate reservoirs; the sites being fixed to give a head of not less than 60 feet, or more than about 150 feet above the pavement level. If the reservoir only supplies water to property around the hill upon which it is built, the pressure can be decreased by a reducing valve; but where the pipes run across a valley to supply property on another hill, it is not advisable to lower the pressure.

The depth of service reservoirs is generally between 9 and 18 feet; the most economical depth, considering all things, probably being within the limits of 12 and 14 feet. Low walls are much cheaper per foot in height than high ones; and this should be carefully considered when designing a reservoir.

For covered reservoirs, the economical depth to be excavated under the original surface of the ground may be taken at from 50 to 60 per cent., and for open ones at from about 45 to 50 per cent., of the height of the wall. If the soil can be excavated by machinery, it will pay to do it if the quantity exceeds 30,000 cubic yards; the cost then being from 9d. to 1s. per yard. The filling behind the walls should be of selected earth, brought up in 9-inch layers, slightly watered, and well rammed. The embankment should be consolidated in the same way, and finished with a slope of from 2 to 1 to 3 to 1, according to the character of the material; but it should in no case exceed its natural slope. Embankments settle about 1 inch per foot of depth, and enough soil should be left on the ground to bring them up to their full height after settlement. On completion, the embankment should be turfed or sown with grass seeds; but on no account should trees be planted immediately behind or near the reservoir walls.

The inlet-pipe may be below, but is better above, the water-level in the reservoir. If it is desirable to shut off the water when the reservoir is full, rather than let it run to waste, it can be done by fixing a float-valve in the reservoir; and if in connection with a pumping-engine, the increase of pressure in the pipe due to the float-valve closing can be made to shut off the steam, or other motive power, and thus stop the machinery.

The outlet supply-pipe can be controlled by a valve, either within the reservoir or behind the walls. The best practice is to place the valves in a well behind the walls; so that they can be examined and repaired without interfering with the supply. All pipes under water should have flanges cast on them to prevent creeping, and be laid in fine concrete and grout. The weakest place in a reservoir is, as a rule, along the line of outlet pipes; and, unless they are carefully laid in cement grout, leakage will occur. A screen of some kind, of sufficient fineness to stop fish, newts, eels, and dirt from entering the pipe, should be placed on the entrance to the outlet-pipe. The pipe should also be fixed from 3 to 9 inches above the floor of the reservoir, to avoid drawing off the dirt which settles on the bottom. If it is desired to draw off the top water, a floating draw-off pipe can be used. An apron should be fixed in the reservoir immediately under the inlet-pipe.

The same remarks as to laying the pipe through the wall apply equally to the wash-out pipes. In many cases standing overflows are connected to the wash-out pipes; but this necessitates a valve being placed between the overflow and the inlet to the wash-out pipe, and will probably require a platform to enable the valve spindle to be reached.

Under certain conditions, the inlet or delivery main to, and the supply pipes from, the reservoir may be connected with a bye-pass outside the reservoir, so that when the reservoir is being repaired or cleaned out the supply to the district can be maintained. This, however, is not advisable where the pressure in the delivery-mains is high, as the fittings in most towns might be unable to stand it. On the other hand, any excessive pressure could be lowered to meet the exigencies of each individual case by means of a reducing valve. Otherwise, a dwarf wall could be built in the reservoir, separating it into two compartments, having an outlet-pipe from each; so that either compartment could be cleaned out without varying the pressure on the fittings to any great extent. Ventilators should always be fixed in the roof of covered reservoirs, to aid circulation and control the air pressure, which would otherwise vary with the water-level.

The materials chiefly used in constructing service reservoirs are concrete, brick, puddle, asphalte, and bituminous sheeting. Sometimes these materials are used in conjunction one with another; but the author is of the opinion that puddle is used in many cases when there is absolutely no necessity for it. Of late years, concrete has been largely used for water-works purposes; and if properly made, it is a very desirable material. The thickness required in a reservoir floor will, to some extent, depend upon the depth of water, the geological nature of the ground, and the class of concrete used. A rough-and-ready rule for a fairly good floor of concrete alone is to make the thickness of concrete equal to one-twelfth of the depth of water, with a minimum thickness of 6 inches; the concrete being 6 to 1, and rendered with cement and sand in equal parts. This thickness can be reduced if either asphalte, puddle, or bitumen sheeting is used in conjunction with the concrete.

Asphalte, asphalte concrete, and concrete slabs are now being used for covering the floors of reservoirs; the joints being filled up with asphalte or cement mortar respectively. To avoid cracks in concrete due to expansion and contraction, it would be an improvement if the joints were run with asphalte. York stone, brick, and cobble stones are also used; but the first is expensive, and the two last are dirty. If strength is required with a minimum thickness, concrete slabs with expanded metal embedded in them, as at Cardiff and Warrington, can be used. All rendering should be done before the concrete sets, or if this is impossible, the surface should be roughed and washed before the coating is put on. The concrete commonly used in reservoir construction varies from 5 to 1 to 7 to 1, and should be made of clean materials, with a large percentage of small stuff and sand; and if crushed by machine, the fine dust should always be retained. How to lay concrete is a subject which is frequently discussed; and the author favours a rather but not too wet concrete, so as to obtain a mass which, when slightly rammed, moves like an ordinary table jelly, and brings the liquid cement to the surface.

Puddle varies considerably in different localities, and where for a certain head 1 foot would be sufficient in one case, in another, 2 feet would be required. The best puddle for water-works construction is the bluish-grey clay common in the carboniferous formation of the mining districts. The worst kind known to the author is the Devonshire potters' clay, known as kaolin, it being the disintegrated felspar of granite rock. Some of the yellow clays, however, are very good. To test clay for water-works purposes, a piece about 1 inch diameter should be rolled to about 1 foot long; and if it will support itself without breaking when held by one end, it may be classed as good. The weight which can be put on good clay varies from 1½ to 4 tons per square foot. An admixture of cinders with puddle will stop rats from making passages through it. Puddle and concrete can be used together with advantage when the reservoir is constructed on a permeable formation or jointed rock; but when there is a probability of unequal settlement, it is advisable to use puddle, with asphalte or bituminous sheeting laid on the top of bricks driven into the puddle, as this gives a considerable amount of elasticity.

The thickness of the puddle generally varies between 9 and 24 inches, according to the class of material and the head of water to be resisted; but when it is used for reservoir floors, it ought to be well selected and placed *in situ* in thin layers, well worked by cutting, cross cutting, and ramming. Dirty joints must be avoided; and if a little gravel is added to the puddle, it will increase its weight-carrying capacity, and prevent it shrinking or cracking quickly. When there is a good natural bed of clay at the bottom of a reservoir, as in some of those in the Thames Valley, a thin layer of cement concrete, or concrete slabs, will be sufficient to protect it and facilitate cleaning out. Good clay beds or solid rock make the best foundations; but the rock should be stepped if there is a considerable dip in the strata, and in clay beds, the puddle core of the embankment should be sunk 2 to 4 feet into the natural clay.

Gravel and coarse sand make good foundations if kept from spreading, whereas silt and fine sand give much trouble, and, as a rule, require piling. If the bottom of the reservoir is founded on book-leaf clay, care must be taken to see that it is stable and not inclined to slide on its beds. This clay is very treacherous; and great attention is required to make a successful job of work founded upon it.

Reservoirs should never be constructed on made ground unless it has been thoroughly consolidated; and even then it may be advisable to increase the footings, or carry piers down to the original ground level, so as to act as bearing pillars. Where the bottom of a reservoir is waterlogged, or of very absorbent material, and there is any difficulty in getting the concrete to set, the construction applied at the Charlottenberg reservoir of the Berlin Water-Works can be adopted—bitumenized paper being spread over the bottom previous to the first layer of concrete being put in. There is greater difficulty in dealing with the floors of covered reservoirs than with open ones, because the weight of the piers, walls and floor gives rise to unequal pressures on the foundations.

Where springs are met with, the water should be led away from the site, or if, owing to the contour of the surrounding land, that is impossible, a valve may be placed in the bottom to allow the water, if pure, to enter the reservoir.

Practice varies considerably in the designing of service reservoir walls; some being economical in design, while others are far from it. At the same time, we must not be led to conclude that the heaviest wall necessarily shows an example of bad design; for there are cases where local conditions make it absolutely necessary to construct heavy walls, and one design for all cases cannot be adhered to. Considering the large number of retaining walls that have been erected in connection with railways, gas-works, and water-works in this country, our knowledge of the lateral pressure to which such walls are subjected is very small indeed. Walls built of heavy material need not be quite as thick as those of lighter weight. The length of a wall also has a considerable influence on its strength; and it is advisable to construct long walls with a heavier section than short ones. Counterforts, no doubt, effect a slight saving in material; but the total cost of construction is about the same.

In deep reservoirs, or where the bottom is compressible, it is best to build the wall first; and thus obtain the advantage of shoring up the earth at the rear of the wall during construction. Unequal settlement, and consequent breaking of the concrete used for the floor of a reservoir, is also thereby avoided.

Among the numerous examples of walls shown by the author were two designed by himself. One has a thickness of base one-third of the height, and would do very well in good earth. The thickness of the other is four-elevenths of the height, and gives a rather heavier section, which might be adopted where the earth backing is not so good as in the first case.

The thickness and stability of the walls may be calculated by means of Rankine's and other well-known formulæ, or by the graphic method given in Rivington's "Notes on Building Construction," Part 4. It has been pointed out by Sir Benjamin Baker in the "Proceedings of the Institution of Civil Engineers" (Vol. XLV.), that the usual formulæ for the lateral pressure of earth backing give a factor of safety of about 2.

The covering of reservoirs is a matter upon which there is much difference of opinion among engineers and the medical profession. Whether there is any necessity for covering reservoirs depends upon the character of the water, and the purity of the atmosphere in the neighbourhood of the reservoir. Generally speaking, it will be found necessary to cover all reservoirs wherein hard waters are stored, but in some instances only where soft waters are stored. In the neighbourhood of large manufacturing districts, it may be necessary to cover them whether the water be hard or soft. It appears to be common sense that, if water is polluted by the atmosphere, or the action of sunlight causes vegetable matter to grow in abundance, the reservoir should be covered. Dr. Procucci, speaking of the bacterial effect of sunlight, states that there is a marked decrease of bacteria in sunlight and an increase in the dark. Dr. Samuel Rideal also, in his book on "Water, and Its Purification," says: "The improvement of water in reservoirs is largely due to the deposition of suspended mineral matter and bacteria; but, in addition, open storage reservoirs favour the beneficial action of aëration and light."

In deciding the kind of roof to adopt, consideration must be given to the durability and weight of the material it is intended to use. The life of ironwork has been placed by Sir R. Rawlinson at 50 years. If, however, the roof be properly designed, there is no reason why its durability should be less than any other kind of structure, provided the ironwork be embedded in concrete.

Groined brick arches make a good and durable covering; but concrete is much cheaper to construct, and is lighter per square foot of covering, owing to the reduction in the quantity of material required. A light and strong concrete roof can be obtained with a span of 12 feet, rise of 2 ft. 6 in., and thickness at crown of 6 inches; or if granolithic concrete be used, the weight can be somewhat reduced. Groined elliptical arches require a small amount of material, and give clear headroom in each direction, which facilitates ventilation. Semi-circular arches are expensive, owing to the loss of space, as the water-level should never be higher than about 3 inches below the line of springing. There are, however, exceptions where special conditions have to be dealt with.

Among the many ways of covering reservoirs, the following may be mentioned, though Nos. 1 and 5 cannot be recommended: (1) Wood roof with slates. (2) Concrete arches. (3) Girders and jack arches. (4) Girders and concrete slabs. (5) Corrugated iron. (6) Concrete enclosing girders and joists. (7) Expanded metal and concrete. The roof should be well ventilated, and have inspection manholes fixed in suitable positions, so that direct light may never be admitted except when cleaning out the reservoir. For this purpose, a manhole cover 15 in. by 15 in. to every 300 square feet of roof is sufficient. If the roof is carried from the side walls, which in covered reservoirs are usually built with vertical faces, so as to reduce the roof area, they must be designed accordingly, bearing in mind the fact that any outward pressure resists the overturning effect of the earth backing. In America it is a common practice to take the outward pressure of the roof upon a metallic ring fixed near and around the top of the wall. If the roof rises above the surrounding ground level, the effect of the wind pressure transferred to the walls must also be borne in mind. Occasionally, to avoid the turning movement on the wall, the roof is supported from a point some distance behind the side walls. This method can be adopted when it is found necessary to cover an existing open reservoir. When the roof is entirely underground, it is usual to cover it with from 12 in. to 24 in. of earth.

To prevent rain-water entering the reservoir, it is necessary to cover the roof with some impervious material, such as concrete, puddle, asphalte, or bitumen sheeting; the last being the cheapest and lightest. All spandrels should be drained away from the reservoir.

The whole weight of the roof is seldom carried by the walls, excepting in small reservoirs; some portion being, as a rule, carried on concrete or brick piers, or on steel or iron columns. The piers must be designed according to the weight they have to carry and their length. It is cheaper, owing to their small section, to build piers of brick than of concrete; and from one-fifth to one-sixth of the height is the usual width for the side of a square pier. To distribute the pressure over a greater area of footings with the same quantity of material in the piers, a cruciform section is sometimes adopted. Pier footings should never penetrate through the full thickness of the floor, or they will form lines of weakness and leakage; and where there is trouble from upward pressure, inverted arches should be built at the bottom of the reservoir, and the pressure transmitted through the piers or columns to the roof, which can be weighted accordingly.

The cost of executing the work in different portions of service reservoirs may be apportioned as follows:—

For Open Reservoirs.		For Covered Reservoirs.	
Excavation	15 per cent. of total cost	Excavation	10 per cent. of total cost
Floors . .	35 per cent. ,,	Floors . .	24 per cent. ,,
Walls . .	50 per cent. ,,	Walls . .	28 per cent. ,,
		Roof . .	38 per cent. ,,

Small reservoirs are more expensive to construct per 1000 gallons of capacity than large ones.

With regard to the question of rectangular as compared with circular reservoirs, the author thinks that engineers are not fully alive to the advantages to be gained by making reservoirs circular in plan. As to wall length, in a reservoir having an area of 10,000 square feet, if square, 100 ft. by 100 ft., the wall length will be 400 ft.; if rectangular, 80 ft. by 125 ft., 410 ft.; and if circular, and approximately 113 ft. in diameter, 355 ft. There is thus an average difference of 50 feet between the length of the circular walls and the straight ones; and the narrower the rectangular reservoir is, the greater will be the difference.

The cost of a properly-designed open reservoir to hold 12 feet depth of water may be anything between £3 and £5 per foot run of wall. Taking a mean cost of £4 with the above lengths, the relative costs will be, if square, £1600; if rectangular, £1640; and if circular, £1420—representing a saving of about 12½ per cent., or 5s. 4d. per 1000 gallons, on a comparatively small reservoir of 750,000 gallons capacity.

Besides this, in circular reservoirs the walls need not be designed as thick as in rectangular ones; and there will consequently be a large saving in cost. The thickness of straight walls for rectangular service reservoirs varies between a quarter and two-fifths of the depth; while those of circular reservoirs or gasholder tanks have been found strong enough where the thickness has been between the limits of one-sixth and one-tenth of the depth. After careful consideration, it must be concluded that circular reservoirs are from 20 to 40 per cent. cheaper than rectangular ones, although it must be borne in mind that the former are not so economical in ground space as the latter.

Perhaps the finest example in the world of a service reservoir is that at Buenos Ayres, which has a capacity of 16 million gallons, and is built in the French Renaissance style with elaborate enrichments. There are three tiers of tanks, each tier being divided into four compartments, 135 ft. square and 13 ft. deep; each tank containing about 1,324,000 gallons. Each tank is supported upon cast-iron columns, connected together with plate girders. The range of temperature is about 70° Fahr., and the arrangements for dealing with expansion are very neat. In Paris there are several reservoirs of this class; that at Montmartre being, perhaps, the best example.

Mr. F. Storr (Wrexham) said the author stated, in regard to the question of rectangular as compared with circular reservoirs, that engineers were not fully alive to the advantages to be gained by making reservoirs circular in plan. He (Mr. Storr) had built eleven reservoirs, and had for many years abandoned square construction in favour of the circular. He had also discontinued puddle, and used in its place portland cement slurry. One reservoir was 96 feet in diameter by 14 feet deep; and its watertightness depended upon the cement slurry. An economical element as well as a practical one entered into the change. He abandoned the square formation because he could get a much thinner wall in the circular reservoir. He then did away with the cast-iron columns carrying the roof, and put in the carrying arches of brickwork, the piers of which were arranged so that the thrust was not transmitted to the circular wall. He also did away with the heavy brick and concrete arches, and the cast-iron skew-backs and iron tie-rods, and over the top he made a sort of lid of light concrete arches resting upon steel joists. He found by experiment that a 6 feet arch was, as near as possible, the most economical span. Expanded metal was used throughout; and the thrust was taken up by a steel hoop that went right round the top, so that there was no strain or stress at all on the top of the reservoir walls. It was as absolutely distinct as possible from the brick wall as it could be. The stress was taken up by a 10 in. by ¾ in. steel ring; the joists being riveted to the ring by various shaped angle iron. He got a light and fairly economical roof, and one which would bear 18 inches of soil above it. No special skilled labour was required—the work being done by the ordinary navvy. It would thus be seen that at Wrexham they had made a variation in the construction of reservoirs. The concrete on the bottom was of a plain character, mixed 6 to 1, and 12 inches thick; the surface being rendered with 1 inch of cement mortar mixed 2 to 1. With regard to the cost, the concrete on the bottom ran out to 15s. per cubic yard; the concrete (3 to 1) on the top cost 27s. 5d.; the cement slurry in chase cost 31s. 2d.; the brickwork in the outer walls cost 27s. 6d., all in cement; the brickwork for the inner ring of blue "wire cuts" cost £2 4s. 8d.; and the brickwork for the carrying arches £2 4s. 1d. He was thus able at a reasonable cost to make a reservoir which was practically indestructible; and the steel joists were not exposed in any

shape or form to the effects of evaporation—in fact, there was no ironwork exposed in the reservoir. The total cost worked out to £4 5s. 10d. per 1000 gallons. The site on which the reservoir was constructed was a difficult one, being crossed by a fault; but not a single gallon had after three years' use leaked from the reservoir. In fact, he might say that, from the whole of the eleven reservoirs (covered and open) he had built of this form, not one had lost a pint of water through leakage. Drawings showing the method of construction were handed in.

The discussion was then adjourned with the intention of resuming it the following morning; but, owing to the fire in the Town Hall, it was subsequently decided to postpone the further consideration of the paper to the winter meeting—members in the meantime being invited to send in written comments.

On the motion of the PRESIDENT, seconded by Mr. F. J. BANCROFT (Hull), the author was thanked for his interesting contribution.

REGISTER OF PATENTS.

Revivifying Gas Lime.—Yeadon, S. N., and Mason, W. D., of Leeds No. 14,845; Aug. 20, 1900.

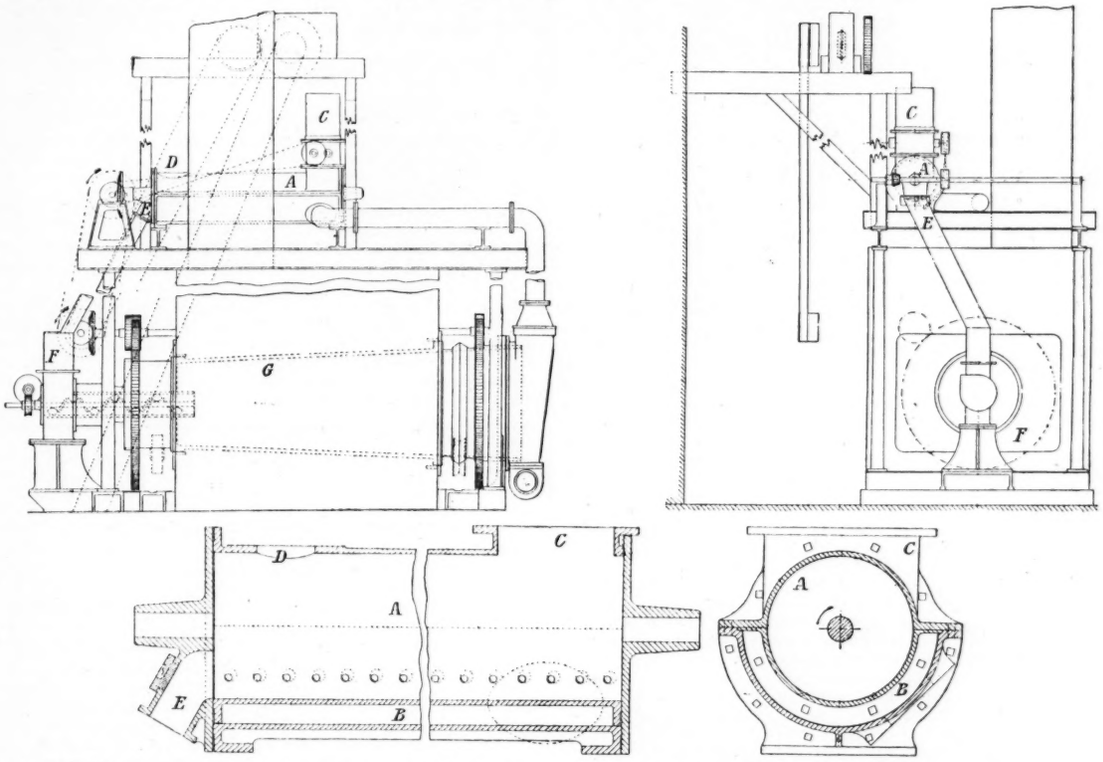
This invention (connected with patents No. 19,183 of 1889, No. 5239 of 1892, and No. 104 of 1895) relates to apparatus for revivifying gas lime by first subjecting it to the action of carbonic acid for the purpose of freeing it from the sulphuretted hydrogen, bisulphide of carbon, and other sulphur compounds it contains, and afterwards passing it through an externally-heated revolving retort, in which the fouled lime, coming into immediate contact with the heated internal surface, is freed from the carbonic acid gas, and thus becomes revivified, so that it can be used again for purifying gas or for building purposes.

The illustrations show a side and end elevation of such parts of the apparatus as are claimed under the present invention, and an enlarged longitudinal and transverse section of the "permeator" hereafter referred to.

The gas lime, as it comes fresh from the purifier, is broken up and delivered into the permeator, which consists of a cylindrical vessel A preferably horizontal and made in two halves; the lower half being fitted with an outer air-tight jacket or cover with space B between. At one end is fixed a feed-hopper C, having regulating rollers for the lime; and revolving inside the permeator is a shaft fitted with blades or knives for stirring up the lime and passing it to the discharge end, over which is fixed at D a suitable exhauster for drawing off the sulphuretted hydrogen and other compounds to a condenser for separate treatment.

The space between the lower half of the permeator and its jacket can be used for introducing waste heat from the furnace-flues. In the lower half of the permeator (near its bottom) are a number of orifices through which the carbonic acid gas is introduced from the interior of the revolving retort below, or from the flues of the heating furnace. These injection-orifices may be fed direct (as illustrated), or may be connected with outside feed-pipes; the object being, by means of the exhauster, to draw or inject carbonic acid gas through the gas lime during its passage through the permeator, and thus thoroughly impregnate it with the carbonic acid gas to form carbonate of lime.

At the exhauster end of the permeator, the gas lime charged with carbonic acid gas (and thus become carbonate of lime) falls through an air-tight passage E into a closed hopper, whence it is delivered into the revolving retort F (the second part of the apparatus); the permeator being preferably erected on the top of the retort-setting.



The revolving retort—constructed and operated in accordance with the earlier patents mentioned—is heated externally. The body is preferably of conical form (as illustrated) on a horizontal axis, or it may be of a parallel form working on an inclined axis—the object being to automatically stir up and convey the material through the retort. In its passage through the retort, the carbonate of lime is continually broken up and brought into immediate contact with the heated internal surface; thus causing the displacement of the carbonic acid gas, and forming calcium oxide, which is discharged automatically through a sealed outlet G.

Manufacture and Purification of Anthracene.—Luyten, L., and Blumer, E., of Marche-les-Dames, Belgium. No. 14,892; Aug. 20, 1900.

In order "to obtain anthracene dry, and rich in chemically pure anthracene," the patentees propose to subject it to a series of operations which may be divided into two classes—viz., (1) those which are effected in tar distilleries, and (2) those which are effected in alizarine manufactories. The only anthracene which crystallizes in anthracene oil, they point out, is separated by simple filtration in bag filters, filter presses, or other apparatus. A crystalline oily paste is thus obtained containing various hydrocarbons—such as anthracene, phenanthrene, acenaphthene, carbazol, and so forth. This crystalline paste containing coal-tar oil (drained crude anthracene) constitutes the point of departure of the present new method or process.

Heretofore the drained crude anthracene was first cold pressed or centrifugalled, and afterwards hot pressed in hydraulic presses, in order to bring the anthracene to a dry state, and to a richness of 30 to 35 per cent. of pure anthracene—the commercial standard required by makers of alizarine. In alizarine factories, the anthracene of commercial standard is brought to a richness of from 60 to 80 per cent. of pure anthracene by washing by means of solvents, such as petroleum ether, pyridine, acetone, sulphide of carbon, and so forth. This anthracene has a richness of 60 to 80 per cent. pure anthracene, and constitutes the substance obtained by this improved method or process, while dispensing with all the intermediate operations. The avoidance of these operations constitutes the object of the present invention.

As a result of methodically conducted researches and scientific study, the patentees claim to have found that for the enrichment of anthracene by treatment with solvents, the tar oil which is contained in the drained crude anthracene is in no way prejudicial, but, on the contrary, is rather useful than otherwise. This demonstration has led them to the present invention, according to which the drained crude anthracene is subjected to washings with various solvents, among others those distilling at a point sufficiently low to permit of their being recovered by simple distillation—that is to say, so that by distilling the solvent it may be separated from the enriched anthracene, as well as the foreign matters, which accompanied it; the temperature at which the solvent distils off being sufficiently low to avoid the distilling off or decomposition by heat of the anthracene or its impurities. They instance naphtha, sulphide of carbon, acetone, and so forth. By this means, anthracene containing 80 per cent. of pure anthracene may be obtained, and this by simple treatment with a light solvent, thereby avoiding all the labour involved in bringing the drained crude anthracene up from 30 to 35 per cent. by means of cold and hot pressings.

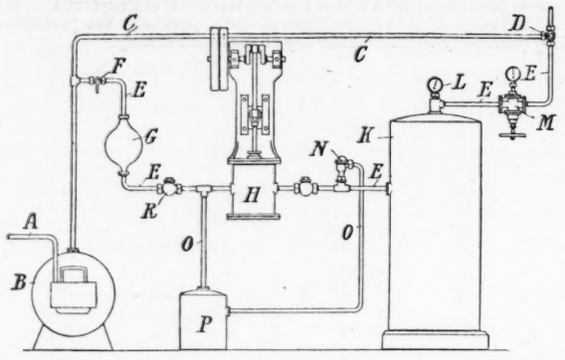
The following is an example of the process: 25 parts of drained crude anthracene are heated with 35 parts of naphtha until near the boiling-point of the solvent (say, naphtha). It is then left to cool, whereupon the anthracene crystallizes, while nearly all the other

matters remain in solution. They then filter and wash the anthracene with a little of the solvent; and the solvent is recovered by distillation. It now only remains to dry the anthracene, for which purpose it is heated to its point of fusion, and the solvent is distilled off and recovered.

High-Pressure Incandescent Gas-Lighting Plant.—Boult, A. J.; a communication from the Société Lumière Boule, of Brussels. No. 8817; April 29, 1901.

This invention consists in a combination of apparatus by means of which gas taken from town mains is highly compressed and fed to the lamps under constant uniform pressure, quite independently of the number of lamps burning. The individual parts of the apparatus are of well-known construction; the invention lying solely in the combination of the apparatus for the particular purpose described.

The gas taken from the main first enters, through a pipe A, into the meter B, from which a pipe C conducts it to a three-way cock D. From the pipe C branches a pipe E, provided with a stopcock F. Through this the gas from the main at a low pressure enters a runner-bag G, and is by suction withdrawn from the latter by a compressor H (a suction-and-force pump), and forced through the continuation of the pipe E to the receiver K, which consists of a cylindrical vessel provided with a pressure-gauge L. Here the gas is compressed to (say) 3 to 5 atmospheres. In the continuation of the pipe E from the receiver, a reducing-valve M, also provided with a pressure-gauge, is inserted. "By means of the latter, the compressed gas can be fed to the lamps at a perfectly definite and uniform pressure, which may be regulated from time to time according to the number of lamps burning."



Should only a small number of lights continue to burn, the pressure in the receiver K will naturally increase considerably, while the compressor H will continue to pump in more gas, and the valves of the compressor would be subject to injury. In order to obviate this danger without having to stop the compressor, a back-pressure valve R is inserted in the pipe E before the compressor; and behind the compressor, in the continuation of the pipe E, an over-pressure or relief-valve N is provided, which opens on a certain pressure being reached in the receiver K, permitting the excess gas to pass through a pipe O into a chamber P, where it can expand, then passing further at reduced pressure through the continuation of the pipe O to the pipe E again on the other side of the pump. Being still under a higher pressure than the supply from the main, however, it will close the back-pressure valve R, so that the compressor cannot draw in gas from the pipe E, but only the gas from the chamber P or receiver K.

The insertion of this branch O and chamber P in the system is important (says the patentee) for the purpose of diminishing the pressure of the gas, and so protecting the compressor-valve from undue wear and tear, whereby regular working of the pump is ensured.

When the pressure in the receiver K has sunk to the normal, the relief-valve N will close and the back-pressure valve R will re-open, so that gas from the bag G may again enter through the pipe E. If the plant is to be stopped working, and at the same time the supply of low-pressure gas from the main allowed to feed the ignition flames which burn day and night, the three-way cock D must be turned so as to close the pipe E. The cock F must likewise be turned to close the pipe E.

APPLICATIONS FOR LETTERS PATENT.

14,396.—Murphy, W. J., and Paton, R. J., "Gas-igniter for oil-engines." July 15.

14,447.—Stechow, C. von, and Svensson, J., "Opening and shutting gas-valves by producing differences of pressure in the pipes." July 16.

14,449.—Böcker, G., "Valve for economizing gas." July 16.

14,483.—Lencauchez, J. A., "Purification of gases." July 16.

14,504.—Cannon Iron Foundries, Ltd., and Ward, T., "Burner for gas-fires." July 16.

14,513.—Karfunkelstein, C., "Carburating apparatus." July 16.

14,536.—Turner, A. W., and Wood, H., "Inclined retort coal-stops." July 17.

14,568.—Andrews, F., and Ohren, A. M., "Gas-ovens." July 17.

14,583.—Kay, J. S. G., Higgins, W., and Posener, A. M., "Carburetting air for lighting, heating, and motive power." July 17.

14,606.—Yorke, R. F., "Gas-engines." July 18.

14,653.—Boult, A. J., "Manufacture of water gas." A communication from J. E. Goldschmid. July 18.

14,654.—Burkamper, H., "Burners." July 18.

14,668.—Carpenter, C. C., and Webber, W. H. Y., "Gas manufacture." July 18.

14,690.—Shinton, A., and Turner, J., "Gas-stoves." July 19.

14,733.—Nehmer, H. & F., "Lighting gas by electricity." July 19.

14,759.—Clark, A. M., "Manufacture of gas." A communication from J. E. Goldschmid. July 19.

14,763.—Treichler, D. H., "Acetylene generators." July 19.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read a second time and committed: Derby Corporation Bill.

Bills reported, with amendments: Biggleswade Water Board Bill, Cromer Water Bill, Rhyl Improvement Bill, Shipley Improvement Bill.

Bills read the third time and passed: Biggleswade Water Board Bill, Blackburn Corporation Bill, Bradford Corporation Bill, Golborne Gas Bill, Kirkcaldy and Dysart Water Order Confirmation Bill, Rhyl Improvement Bill, Wells Corporation Water Bill.

Bills Royal Assented: Aldershot Gas and Water Bill, Bingley Urban District Council Bill, Burgess Hill Water Bill, Burton-upon-Trent Corporation Bill, Bury Corporation Bill, Colwyn Bay and Colwyn Urban District Gas Bill, Derwent Valley Water Board Bill, Dorking Gas Bill, Dover Gas Bill, Edinburgh and District Water Order Confirmation Bill, Faversham Water Bill, Gas Orders Confirmation Bill, Gas and Water Orders Confirmation Bill, Handsworth Urban District Council Bill, Kettering Urban District Water Bill, Kingston-upon-Hull Corporation Bill, Llandrindod Wells Urban District Council Water Bill, Mansfield Corporation Bill, Metropolitan Water Companies (Amendment of Acts) Bill, Petersfield and Selsey Gas Bill, Poulton-le-Fylde Gas Bill, Prestatyn Water Bill, Richmond Gas Bill, Sheffield Corporation Bill, Stroud Gas Bill, Swanage Gas and Water Bill, Tees Valley Water Board Bill, Tendring Hundred Water Bill, Water Orders Confirmation Bills (Nos. 1 and 2), Winsford Urban District (Gas-Works Transfer, &c.) Bill, Wisbech Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills reported, with amendments: Dover Corporation Bill, Ripon Corporation Bill, Salford Corporation Bill, Southport Water (Transfer) Bill, Stratton and Bude Improvement Bill, Weston-super-Mare Gas Bill.

Lords Bills read the third time and passed: Dover Gas Bill, Edinburgh and District Water Order Confirmation Bill, Elland Gas Bill, Kirkcaldy and Dysart Water Order Confirmation Bill, Stockport Corporation Water Bill, Water Orders Confirmation Bills (Nos. 1 and 2).

Last Tuesday, a Bill "to vest the undertakings of the London Water Companies in a single public authority, and for other purposes," was brought in by Sir Blundell Maple, Mr. Cust, Mr. Kimber, and Mr. Arthur Morton, read the first time, and put down for second reading on the 6th prox. On the motion of the introducer, the Bill was last Friday referred to the Examiners.

LEGAL INTELLIGENCE.

PROTECTION OF TRADE SECRETS.

Charges against Workmen.

The business of the Leeds Stipendiary's Court was largely occupied on several occasions during the past week with the hearing of charges against two confidential employees of Messrs. George Bray and Co., of Leeds. The defendants were Charles Duncan, residing at Headingley, and Charles M'Cullough, or Colley, of Blackman Lane. The prosecution was conducted by Mr. E. O. Simpson; while Mr. Arthur Willey defended Duncan, and Mr. Clifford Dunn appeared for M'Cullough.

The formal charge against the men was that of "stealing a quantity of appliances and material in reference to the manufacture of gas-burners." Mr. Simpson first stated the case against Duncan, who, he said, had been one of Mr. Bray's foremen, and was engaged in work which required that absolute secrecy respecting it should be observed. The particular appliance upon which he was employed was called a union-jet tip-making machine, which made the clay-tip part of the burners. It required constant adjustment, and it was absolutely necessary that it should be in charge of a good mechanic. After Duncan had been for nearly three years in Mr. Bray's service, he, in January last, gave notice to leave; one of his reasons being that he was dissatisfied with the wages he was receiving—35s. a week. He stayed on, however, until March, when inquiry showed that he had taken a shop in Westfield Road. At that shop, said Mr. Simpson, was found certain material which Messrs. Bray would identify as their property; while at his lodgings were discovered a number of tracings of nearly all the machines at Messrs. Bray's works, and an exact scale drawing of the furnaces specially constructed for burning the clay for the tips. In addition, there was found some extremely delicate adjustments of machinery, and some special burners which could have been procured only from Messrs. Bray.

After a second remand, Duncan again appeared before the Stipendiary Magistrate (Mr. C. M. Atkinson) on the 23rd inst., when Mr. Bray, who stated that he was the sole proprietor of the business of Messrs. George Bray and Co., deposed to the material found by the police at Duncan's lodgings as including fourteen drills, and a lamp governor-burner, which had been taken from witness's works without his consent. On this occasion, Duncan was further remanded until the 31st inst. (to-morrow).

The defendant M'Cullough's case was exhaustively gone into last Wednesday. From Mr. Simpson's opening remarks, it appeared that

the defendant had been in Mr. Bray's service for about 27 years. At the time he left, he was one of some twelve or fourteen foremen in the place. His salary was £2 a week, with an annual bonus ranging from £40 to £70. He left in July last year; and in a letter which he wrote he stated that ill-health prevented him continuing his employment. Mr. Bray bestowed several acts of kindness upon him. On the 9th of May, defendant replied to an advertisement in the "Yorkshire Post," by Messrs. Milne and Son, and when Duncan's premises were searched, the draft of a letter, obviously prepared by Colley (by which name he was more generally known), was discovered; but whether it was ever delivered to Messrs. Milne, said Mr. Simpson, they might probably know later. In that letter were very full details of Mr. Bray's works, what Mr. Bray was doing, and how his business had grown, &c. On Colley's premises were found a model of the union-jet tip-making machine and other articles. When the search had been completed, Mr. Bray was summoned to the house, and Colley admitted that he had himself taken the drawings and supplied the tracings to Duncan, and that he had taken the material and drawings on the chance of there being some split between Mr. Bray and himself. Mr. Bray went into the box and stated that Colley had no authority whatever to take anything from the works. He also detailed the conversation between himself and Colley after the search. Mr. W. D. Helps (Messrs. Milne's Manager) was exhaustively examined as to certain interviews he had had with Colley. He asserted positively that the talks were merely respecting Duncan's capabilities; Duncan having applied to them for employment. Mr. Helps swore emphatically that Colley did not divulge a word about Mr. Bray's business during these interviews.

For the defence, Mr. Dunn contended that the articles taken by the defendant were in every-day use, and had been employed for a considerable time. The defendant took them home, not with any felonious intent, but simply for the purpose of experimenting with them. It was certainly foolish of him to act as he had done. Mr. Dunn pleaded for the case to be dealt with there and then, as Colley's health was gradually being undermined by the terrible strain put upon it in consequence of such a charge hanging over him.

The Stipendiary Magistrate said he could not see that the defendant had any "colour of right" to remove the things. They were taken away by the defendant knowing that he was acting wrongly; but he (his Worship) would not say that Colley was acting as a common thief. He ordered him to come up for judgment after Duncan's case had been dealt with.

THE ELECTROLYSIS QUESTION IN AMERICA.

The Peoria Litigation.

In the "JOURNAL" for the 25th ult. (p. 1765), reference was made to the above matter, in connection with a report which had been filed in the United States Circuit Court for the Northern District of Illinois, by Special Master Frank L. Wean, on certain proceedings instituted by the Atlantic Trust Company against the Peoria Water Company, and by the latter Company against the Central Railway Company and others, in respect of damage to the Water Company's mains. As the question of electrolysis has been a good deal before our readers of late, we reproduce, from the "Engineering Record," the following extracts from the report.

On March 21, 1898, Cornelius B. Gold, the Receiver of the Peoria Water Company, presented a petition to the United States Circuit Court for the Northern District of Illinois, in which it was alleged that the Railway Companies therein named were destroying the plant and property in his custody by electrolysis; the prayer of the petition being for an injunction, operative after a reasonable limit of time, against the further working of electric cars, until the defendants had made use of such appliances as would prevent the grounding of electric currents and their coming in contact with the pipes and mains of the water-works system. On Aug. 4, 1898, the Court entered an order in which, among other matters, there was set forth the pendency of the proceeding against the Railway Companies, and the discharge of the Receiver was ordered to be without prejudice to such suit. By an order of Court made on the same day, the Water-Works Company, then the owners of the property, were, by amendment, substituted for the Receiver, as complainants in the petition, and thereafter evidence was taken, by agreement of the parties, in Peoria, Chicago, Cincinnati, New York, Brooklyn, Albany, Philadelphia, Pittsburg, Milwaukee, and Terre Haute.

The Central Railway Company and the Peoria and Prospect Heights Railway Company, the defendants, at the time of filing the petition, were operating all the street railway lines then existing in Peoria and its vicinity, consisting of about 43 single-track miles of electric railway; and the cars on all the lines were at the time being operated by electric motive power supplied from the power station of the Central Railway Company. The original ordinance authorizing the Company to use electricity in the propulsion of the cars was granted by the Common Council on May 16, 1889. Among other provisions, it contained the following:—

Section 2.—Said Company shall operate said railway and propel its cars by electric motive power and not otherwise.

Section 22.—Said Central Railway Company shall be liable for, and pay to the persons, companies, or corporations injured, all damages which may result from the passage of this ordinance, or from carelessness, negligence, or misconduct of the Company, or any agent or servant of the Company, in the operation of the railway or railways which it may build, own, lease, or control.

Other ordinances have been passed by the Common Council from time to time, granting privileges, with certain qualifications, to the defendants and other street railway Companies; but there is no material change made by any of these ordinances of the provisions above quoted. None of these ordinances prescribes the particular system of operating by electricity to be used by the defendant Companies.

There are at present 17·84 miles of streets in Peoria in which the complainants' water-mains are laid, and on which the defendants' street railway lines are located and operated. Of this mileage, 15·5 miles of water-mains now constituting an important part of the complainants' system were in existence, laid in these streets before any license was granted by the city to lay street railway tracks or to operate any kind of street railway.

The defendants, at the commencement of the action, and for a considerable period prior thereto, were operating their railway lines by the overhead single-trolley system. The railway tracks of their railways are necessarily electrically uninsulated from, and in electrical contact with, the earth, although in the business portion of the city the streets upon which such tracks are laid are, for the most part, paved with a brick pavement laid on a concrete foundation. Part of the return electric current, after going through the car motors to the tracks, finds its way from the rails, through the ground, to the water-pipes of the complainants, and makes use of them as a part of its circuit back to the generator in the power station. Wherever the current escapes from the pipes into the moist earth, it sets up a chemical action which causes a decomposition of the metal pipes that is similar to the action which takes place in an electro-plating bath.

The soil in and around Peoria, in which the water pipes and mains of complainants' system are laid, is of a moist, sandy character, and often furnishes a path of comparatively low resistance to the electric current. Samples of soil which were taken from the immediate vicinity of their service-pipes show traces of lead which had been deposited there by the action of the electric current; and the metal from these water-pipes is frequently found deposited in the form of some of its compounds along the path of the current from the pipe to the rails of the defendant Companies. Samples were analyzed from pits in complainant's water-pipes, and from the soil in the vicinity of such pipes. The materials which came from the pits in the cast-iron water-pipes were found to be the products of decomposition of the metal in the pipes, resulting from the defendants' electric current passing through the salts in the surrounding soil. This action, produced as aforesaid, has destroyed many lead service-pipes of the complainants, and has resulted, so far, in pitting and weakening many of the pipes and mains of their water-distributing system.

In the months of May and June, 1894, an extended examination of the water-piping system then in the possession of the Receiver of the Water Company was made by electrical experts, and more than a 1000 electrical measurements taken, which showed that at that time there was in every instance a difference of potential, indicating a flow of current between rails and pipes. This difference of potential or electrical pressure was found to vary from a fraction of a volt up to 45 volts. The measurements showed that in some places the flow of current was from the rails into the pipes, and in others from the pipes into the rails. Actual tests made at the time showed a loss of metal in single service-pipes of more than 1 lb. of metal per month; the observations indicating that many other pipes were deteriorating at the same rate. Excavations were made in a number of places, for the purpose of inspecting the pipes to ascertain their actual condition. Many of these pipes were found to be wasting away; and there was evidence that rapid electrolytic action was taking place.

On April 6, 1894, the Receiver, who was in possession and operating the water-works plant, caused notification to be made to the Central Railway Company as follows: "That the Peoria Water Company for a long time past has been, and is now, daily suffering and sustaining great injury and damage to its lead and iron pipes and other underground property in the streets and alleys of Peoria; that it is put to great labour, expense, and trouble in making and keeping up repairs on its said pipes, by reason of the improper and unlawful use by you of the ground as a return conductor for electrical currents, and by the illegal, careless, and improper use of electrical currents generally, by you." Similar notices were given to the Mayor and Common Council of Peoria, calling upon the city for protection under the water-works ordinance against damage which the notices alleged was then being suffered.

Another examination of the water-piping system now owned and operated by the complainants, but then in the possession and custody of the Receiver, was made in the early part of 1898, by the same experts who conducted the examination in 1894. An electrical survey was made with a view to a comparison between the conditions existing in 1894 and 1898. The experts found and reported that the destruction was taking place more rapidly in the latter than in the former year, and was being caused by electric currents generated by the defendants.

During the taking of defendants' testimony in this case, it appeared from the evidence that some of complainants' iron gate-boxes were located near the rails of defendants' track; and it was contended by defendants' Counsel and experts that enough current was diverted, by reason of the proximity of these boxes, to account for all the electrolysis claimed by the complainants. It was contended by the complainants and their experts that in no case did any actual contact exist between the box and the rail, except in instances when a car was passing over the box. Nevertheless, 35 of these boxes were taken out and replaced by vitrified tile pipe—a non-conductor of electricity. In other cases, the boxes were entirely removed and not replaced, because they were not needed. This change left no boxes within a foot of the rails. Examinations and tests made by both parties after this change in the boxes showed large quantities of electric current from defendants' system still travelling along complainants' pipes.

In June, 1899, after considerable improvement had been made by the Railway Companies in the way of heavier rails, better bonding, and an improved return-feeder system, another electrical survey was made of the existing conditions between the rails of the Railway Companies and the water-mains of the complainants. This survey proved that a large volume of current was still flowing between the rails and the pipes; the voltmeter showing ten different readings of 10 volts and upwards—the highest found being 35 volts, rails positive to pipes. A difference in potential of the fraction of a volt will cause electrolysis; and from the conditions herebefore found and stated, the ultimate destruction of complainants' pipes by the currents of electricity allowed to escape from defendants' system is only a question of time and pressure.

The evidence discloses no known method by which the complainants, by their own action, can protect their water-distributing system of pipes and mains from the electric currents of the defendants' single-trolley railways, nor any complete remedy for the injury to these water-

pipes, except the entire removal of electric current from the water-mains. Such removal is impossible so long as the return currents of the electric railways are grounded or in electrical contact with the earth. The other methods which have been suggested by the defendants in this case do not, in practice, and cannot, prevent the escape of a portion of the current into the ground and water-pipes.

The defendants can prevent the injury by controlling the current, generated as aforesaid, by the use of a complete metallic circuit insulated from the rails and ground, and providing a channel for the return of the current to the generator as perfect as the channel that is provided to supply the power along the street for use. In the district of Columbia, outside the City of Washington, the double-trolley has been, and is being, installed in a number of roads, under Acts of Congress, providing, in substance, that where the overhead trolley is used it must be the double-trolley; also that no portion of the electrical circuit shall, under any circumstances, be allowed to pass through the earth; and that neither pole of any dynamo furnishing power to the line shall be grounded. This action of Congress was caused by the interference of the electric current of the single-trolley railways with underground metallic structures in Washington and the surrounding territory. The overhead double-trolley system has been used in Cincinnati for ten years, and has been shown by experience during that time to be practical, economical, and satisfactory; and the evidence shows that by its use in this case, the return currrent might be carried back to the dynamos without coming in contact with the earth at all, and the difficulty from electrolysis thus be completely overcome. The original cost for the installation of the double-trolley system is considerably more than for the single-trolley system. While the evidence in the record as to the exact cost of changing the defendants' system from the single to the double-trolley is conflicting and unsatisfactory, it is sufficient to determine the fact that such cost would not be so unreasonable and excessive as to make it impossible for the defendants to adopt the double-trolley system.

The defendants' negative return system is as good as, or better than, the average used by overhead single-trolley electric street railways in cities of the size of Peoria; and the defendants have done all that can be done under the present state of the art, so long as the single trolley is used, to care for the safe return of their electric currents. Notwithstanding this, it clearly appears from the evidence that a portion of the returning current continues to escape to complainants' piping system, and necessarily causes injury, and ultimately destruction, thereto. At least 25 miles of complainants' water-mains are laid under streets paved with permanent and expensive pavement, and practically no access can be had to these mains except when it is made necessary by actual breaks in the pipes. The fact of injury to these mains in this territory from the electric current of the defendants is capable of demonstration, and has been demonstrated in this case, though it is impossible to determine the exact extent of the injury to the whole system at any given time.

The ultimate facts disclosed by the evidence may be briefly summarized as follows: (1) The injury complained of exists. (2) It is permanent and continuing. (3) It has been, and is being, caused by the defendants. (4) The complainants can do nothing to prevent the injury. (5) The defendants can prevent it by use of the overhead double-trolley system, or by any system which provides a completely insulated metallic circuit for the electric current. (6) The overhead double-trolley system, though more expensive to instal, has been demonstrated by use and experience to be as safe, economical, and satisfactory in its operation as the single-trolley system.

In Illinois, there is vested in municipal corporations the power of exclusive control over the streets, and in many cases a fee-simple title to the streets; and, under the power of this exclusive control, it is well settled, by the decisions of the State Courts, that the municipal authorities may do anything with, or allow any use of, streets which is not incompatible with the ends for which they are established; that the laying of water-pipes is among the purposes for which the use of streets may be granted; and that the laying of such pipes underground is much less of an obstruction and interference with the ordinary purposes of a street than the laying and maintaining of a railway track upon its surface. In view of the law of Illinois relating to the use of streets, which has become a "rule of property," and therefore will be followed by the Federal Courts, it cannot be held that the use of the streets for water-pipes is in any sense subservient to their use for electric street railway purposes, assuming that both uses have been granted by the Municipality in the proper exercise of its authority.

Both parties to this suit acquired their rights in the streets by a grant under statutory authority from the City of Peoria by ordinance passed by the Common Council. Each occupies the streets by legal authority. Each is performing a duty to the public, and each is compelled, under the ordinance of the city and the law, to serve the public. Each has money and property invested in its system and plant, a considerable portion of which, in each case, occupies the streets by such legal authority. Both are entitled to the equal protection of the laws against the invasion of their rights and property by others.

The injury which is being done to complainants' water-pipes by the defendants' currents of electricity is not a mere incidental injury or inconvenience, but is a permanent, continuing injury to a legal right, which will, in effect, if the injury is permitted to go on, ultimately result in the absolute destruction of complainants' plant and property. This would amount to nothing less than the taking away from complainants of the use of their property by the defendant Companies, which, if it be done under their licence from the city, authorizing them to "propel their cars by electric motive power," would be a taking of private property for public use. The Constitution of Illinois provides that "private property shall not be taken or damaged for public use without just compensation."

The licence from the City of Peoria to the defendants, while it grants the right to them to lay their tracks and "propel their cars by electric motive power," does not assume to give the "right" to so construct or operate their systems as to damage the property of others who have equal rights to the use and enjoyment of their own property. *A fortiori*, this is true, because of the fact that it is possible for the defendants to so construct and operate their railways by electric motive power as not to interfere with, or injure, the water-pipes of the complainants. But even if such licence did assume to grant the "right" to operate in the manner in which the defendants are operating, regardless of injury to others, the law would not tolerate such use, because of the provisions of the Constitution above quoted.

The injury complained of in this case is the direct and immediate result of defendants' acts—as much so as if the defendants were to deliberately uncover and destroy by any other means the water-pipes of the complainants. The defendants, by taking the necessary reasonable precautions in operating their railways, would be able to avoid the injury; and, this being true, their failure to take such precautions must be considered as negligence. It is as much the duty of the defendants, then, to refrain from injuring the property of the complainants by the one method as it is by the other. The complainants are as much entitled to protection against the injury from defendants' electric currents negligently allowed to stray upon their property as they would be to protection from the wanton destruction of their property by any other direct means which might be employed by the defendants. The maxim "*Sic utere tuo ut alienum non lædas*" applies even under the strictest limitations of the rule which have ever been applied by the Courts in any case.

Although the defendants are operating their railways under ordinances from the city granting them a licence to propel cars by electric motive power, and in so doing are interfering with the property and water-pipes of the complainants, such interference and injury is not *damnum absque injuriâ*, because: (1) It is possible for the defendants to so operate their railways by electric motive power as not to injure the complainants' property. (2) It is impossible, by any known method, for the complainants to protect their property from such injury. (3) Where there are two methods of accomplishing a legal result, and one will work an injury to another while the other will not, it is the duty of the person doing the thing to use the method which will not result in injury to such other person. (4) The failure on the part of the defendants to observe such duty constitutes negligence; and when it results in damage to another, such damage is actionable.

The injury found to be going on in this case is the direct consequence of the unnecessary and wrongful acts of the defendants in accomplishing a legal result—that is, the propulsion of cars; and, unless the defendants are protected by their licence from the city, they are liable to the complainants for such injury. These acts, unnecessary and wrongful in themselves, are not rendered lawful by the ordinance granting the use of the streets for the purpose of propelling cars by electric motive power; and, inasmuch as they work "hurt, inconvenience, and damage" to the complainants, they constitute a nuisance which is actionable at the suit of the injured party.

The injury complained of being actionable, there can be no doubt of the power of the Court to grant some remedy. The damage already done is chargeable to the defendants; and, so far as such damage is capable of being definitely ascertained, the defendants should be held liable in a suit at law. But a suit and recovery at law would not stop the injury, which is, and must necessarily be, continuous under existing conditions. The very life of the complainants' plant and franchise is threatened. The only adequate remedy is, therefore, by injunction, as prayed in the petition.

The Special Master's conclusion is that the bill and evidence make a case of equitable jurisdiction, and that an injunction should issue, as prayed, subject to such reasonable conditions as to the Court might seem right.

Ascot District Gas Company.—At the meeting of this Company on Thursday, the Directors will report a profit of £1071 for the half year ending the 30th of June. There will be a balance of £1850 available for distribution; and the Directors recommend a dividend at the rate of 5 per cent. per annum, which will leave £585 to go forward.

Melbourne Metropolitan Gas Company.—Messrs. John Terry and Co., the London agents for this Company, have received by cable particulars of the half-yearly meeting. The profits for the six months ending the 30th of June last were £53,000; a dividend of 4s. 6d. per share has been declared; a sum of £15,000 has been placed to the reserve; and a balance of £13,500 carried forward. Dividends will be payable in Melbourne on the 5th prox., and drafts will be posted to absentee shareholders by the first mail after that date.

Colne Valley Water Company.—In the report which the Directors of this Company will present at the half-yearly general meeting next Thursday, it is stated that during the six months ending the 30th ult. the amount of capital expenditure was £21,419 14s. 11d., which was mostly incurred in payments on account of new works. The profit in respect of the revenue account is £7476; and the balance available for distribution, after paying the debenture stock and preference share interest, and transferring £250 to the reserve account, is £6792. Out of this balance, it is proposed to pay a dividend at the rate of 6½ per cent. per annum; leaving £844 to be carried forward.

Matlock Water Supply.—An important discovery was recently made at Matlock, which is expected to influence the future of the district in an important sense. The Urban District Council had a scheme in hand for an artesian boring; and, after eight months' resultless work on the moor, water was struck at a depth of 200 feet from the surface. This was fitted with pumping apparatus, and last Wednesday Mr. J. Smith, J.P., the Chairman of the Council, in the presence of the members, started the machinery. The output was very satisfactory; being estimated at 120,000 gallons a day. Should this be maintained, the town will be saved a large scheme, calculated to cost £50,000.

Heavy Consumption of Water in Liverpool.—The fortnightly meeting of the Water Committee of the Liverpool City Council took place last Tuesday. The report of the Water Engineer (Mr. J. Parry) showed that the supply for the week ending the 13th inst. was 207,257,000 gallons to the city and out-townships, and for the week ending the 20th inst. 215,131,000 gallons; the supply in the latter week amounting to 36·19 gallons per head per day. In addition 33 million gallons were sent to places outside the compulsory limits. The Chairman (Alderman Burgess) said the supply was the highest on record. The largest weekly supply in 1898 was 186 million gallons; and in 1900, 204 millions. On one day recently, the supply totalled 33 millions.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY.

Half-Yearly Report and Accounts.

The following is the report on the working of the Company in the six months ending June 30 last, which, with the accounts for this period, will be submitted to the proprietors at the half-yearly general meeting on Friday.

The accounts for the past half year show that, after providing for the fixed charges, there remains a balance, including the amount brought forward, available for distribution of £429,751 2s. 3d., out of which the Directors recommend a dividend on the ordinary stock at the statutory rate of £4 8s. per cent. per annum, carrying forward the sum of £97,993 12s. 10d. to the credit of the current half year.

There has been a reduction of 4·05 per cent. in the quantity of gas sold in the half year, as compared with the corresponding figures of last year, which is attributable partly to the material increase in the price of gas, and partly to the condition of the weather during the winter months—there being an almost entire absence of fog and frost—which was not favourable to large demands for gas. As, however, there has been a satisfactory increase both in the number of consumers and in the number of stoves in use in the district, the Directors have ground for anticipating an increase in the consumption of gas under more favourable conditions. The Directors have taken advantage of this temporary reduction in the demand for gas to suspend manufacture at two of the Company's more expensively worked stations.

The reduction in the amount of profit earned during the half year has been brought about chiefly by the following causes: The increase in the price of gas of 6d. per 1000 cubic feet did not represent the full increase in the net cost of coal by 1d. per 1000, the large and necessary expenditure on reconstruction works, to which reference was made in the Directors' report of January last, and the reduction in sales of gas.

The Directors have to report that, owing to the action of Parliament in rejecting the Company's applications for additional capital powers, and to the somewhat depressed state of the market for gas companies' securities, which has rendered it inexpedient to offer for sale the unissued ordinary stock of the Company, they have been obliged to have recourse, during the half year, to the assistance of their bankers to a greater extent than on any previous occasion. Such a condition is, for many reasons, undesirable; and the Company's financial position will be greatly strengthened when the Directors are able to dispose of the balance of the ordinary stock and of the corresponding balance of debenture stock. The Directors have now under consideration a proposal for placing the ordinary stock at par, in accordance with the provisions of the Company's Acts, and, should they be able to agree terms, they will ask the shareholders to provide for the expenses of the issue by means of a deduction from the dividends payable in September and March next.

The Directors have pleasure in announcing that they have entered into contracts for the supply of coal for the current twelve months at an average reduction in price of 8s. per ton on the contract prices of last year; and, although the fall in the price of coal has been attended by a corresponding fall in the price of coke, the prospects of the Company warrant the Directors in announcing a reduction of 5d. per 1000 cubic feet in the price of gas supplied to private consumers throughout the district north of the Thames as from the 1st of January next.

The Company's Bill for further capital powers and other purposes, which received the approval of the shareholders in February last, failed to obtain the assent of Parliament. When the Bill came up for second reading, on the 14th of March, the opposition in the House of Commons was so strong that it was considered prudent to withdraw the Bill. The reason which was urged for the opposition was that the Directors, in framing the measure, had ignored the recommendations of the Powers of Charge Committee of 1899. The fact, however, is that the principal provisions of the Bill—the raising of the additional money by 3 per cent. debenture stock and the scheme for the redemption of the capital to be raised under the Bill with a view to extinguishing "obsolete capital"—not only had for their sole object, and would have undoubtedly resulted in, the reduction in the price of gas, but were directly intended to give effect to such of the recommendations of that Committee as had not been the subject of special legislation. The Directors regret that they have thus again failed to obtain from Parliament powers to raise the capital necessary for the purposes of the undertaking.

The South Metropolitan Gas Bill, which contains provisions for the purchase by agreement of this Company's district of supply and works south of the Thames, has been passed, with amendments, by the Committees of the House of Commons and of the House of Lords, and now awaits the final stages before receiving the Royal Assent.

The Court of Directors has been furnished by the several Engineers of the Manufacturing and Distribution Departments respectively with the usual certificates that all the Company's plant has been maintained in thorough efficiency.

The accounts accompanying the report consist of the usual statements, from which we extract the following particulars:—

The statement of capital (stock) on June 30 stood as follows: Total paid up, £9,303,310; added on conversion, £12,176,490; unissued, £163,190—total amount authorized, £21,642,990. The statement of loan capital stood thus: Total paid up, £2,713,450; added on conversion, £1,479,975; unissued, £130,550—total amount authorized, £4,323,975. The total stock and loan capital authorized was therefore £25,966,965, of which £25,673,225 had been paid up or added on conversion or consolidation; leaving £293,740 unissued.

The capital account shows receipts (with premiums, £1,598,991) to the amount of £27,272,216. The expenditure is shown in the following items:—

Expenditure to Dec. 31, 1900			£12,974,052 8 10
Expenditure during the half year to June 30, 1901—viz.,			
Lands acquired, including law charges	£608 12 0		
Buildings and machinery in extension of works	1,675 17 9		
New and additional mains and service-pipes	17,065 6 2		
Do. do. meters	6,846 8 4		
Do. do. stoves	11,542 10 6		
		37,738 14 9	
Total expenditure			£13,011,791 3 7
Nominal amount added on conversion			13,656,465 0 0
Balance of capital account			603,959 18 0
			£27,272,216 1 7

The balance available for division is £429,751 2s. 3d.; and the statement showing how the Directors propose to appropriate it is as follows:—

June, 1900.			
£193,334	Net balance brought from last account		£221,570 10 5
433,269	Net revenue for the half year		208,180 11 10
£626,603			£429,751 2 3
(£4 8s. per cent.)	A dividend on the ordinary stock—		
£329,848	£4 8s. per cent. per annum on £15,079,885		331,757 9 5
£296,755	Balance carried to next account		£97,993 12 10

The three statements relating to the reserve, insurance, and depreciation funds show that the balances on June 30 were as follows: Reserve fund, £53,304; insurance fund, £86,678; and depreciation fund, £57,880. The insurance fund had to bear in the past half year a sum of £131 3s. 3d., the value of plant destroyed by fires in the Company's district.

The following is the revenue account:—

Receipts.

June Half Year, 1900.		£ s. d.	£ s. d.
	Sale of gas—		
	Common gas, per meter, at 3s. 5d. and 2s. 8d. per 1000 cubic feet	1,736,195 13 4	
£1,554,205	Public lighting and under contracts—		
75,228	Common gas	85,769 19 0	
			1,821,965 12 4
£1,629,434			
23,785	Rental of stoves	..	25,846 17 2
	Residual products—		
£387,332	Coke, less £45,472 19s. 11d. for labour, &c.	408,617 9 8	
13,197	Breeze, less £2498 1s. 7d. for ditto	13,170 10 5	
92,421	Tar and tar products	66,462 9 5	
100,021	Ammoniacal liquor and sulphate of ammonia	68,562 16 5	
			556,813 5 11
£592,971			
£4,663	Rents receivable		4,782 11 9
257	Transfer fees		237 5 0
£2,251,110			2,409,645 12 2

Expenditure.

June Half Year, 1900.		£ s. d.	£ s. d.
	Manufacture—		
	Coals, including oil, dues, carriage, unloading, and trimming	1,159,913 1 1	
£833,451	Salaries of engineers and other officers at works	14,847 10 0	
14,663	Wages, carbonizing £162,917 4s. 9d.	179,909 12 5	
174,194	,, sundries £16,992 7s. 8d.		
16,708	Purification, including £17,843 18s. 10d. for labour	55,049 5 2	
41,636	Repair and maintenance of works and plant, materials and labour, less received for old materials, £5275 9s. 1d.	221,675 9 5	
168,600			1,631,394 18 1
	Distribution—		
	Salaries and wages of officers (including Rental Clerks)	35,744 13 8	
35,658	Repair and maintenance of mains and service-pipes	33,465 19 7	
35,776	Repair and renewals of meters	24,406 8 7	
24,588	Stove fixing, repairs, and renewals	26,300 3 3	
29,863	Gas fittings (automatic meter supplies)	15,495 16 0	
26,575			135,413 1
18,151	Public lamps—Lighting and repairing	..	17,014 5
	Rents, rates, and taxes—		
6,136	Rents payable	6,245 15 3	
120,172	Rates and taxes	133,859 8 11	
			140,105
	Management—		
2,750	Directors' allowance	2,750 0 0	
236	Company's Auditors and Assistant	223 2 0	
11,132	Salaries of Secretary, Accountant, and Clerks	11,359 4 5	
20,639	Collectors' commission	21,192 9 0	
7,118	Stationery and printing	6,936 15 3	
3,508	General charges	3,568 9 5	
			46,030 0 1
5,425	Parliamentary charges	..	872 17 6
652	Law charges	..	922 1 5
2,000	Charges *re* quinquennial re-valuations	..	680 9 10
5,571	Bad debts	..	5,262 16 6
500	Depreciation fund	..	500 0 0
14,262	Annuities	..	14,653 12 11
887	Workmen's compensation account	..	1,006 10 10
	Public officers—		
876	Gas Referees and Official Auditor	1,236 1 10	
1,355	Public testing-stations	849 10 10	
			2,085 12 8
£1,623,092			1,995,941 10 7
628,018	Balance carried to net revenue account		413,704 1 7
£2,251,110			2,409,645 12 2

The net revenue account stands as follows:—

June Half Year, 1900.		£ s. d.	£ s. d.
£560,664	Balance from last account	551,753 10 6	
367,330	Less dividend on the ordinary capital for the half year to Dec. 31, 1900 . . .	330,183 0 1	
			221,570 10 5
£193,334			
628,018	Revenue account	..	413,704 1 7
£821,352			£635,274 12 0

June Half Year, 1900.		£ s. d.	£ s. d.
£66,410	Interest on debenture stock and bonds, accrued to June 30, 1901	..	67,451 7 6
75,999	Dividend on the preference stocks . .	75,999 4 0	
45,500	Dividend on the 3½ per cent. maximum stock	45,500 0 0	
			121,499 4 0
6,840	Interest on temporary loans and sundry funds	..	16,572 18 3
626,603	Balance applicable to dividend on the ordinary stock	..	429,751 2 3
£821,352			£635,274 12 0

The statements furnishing particulars as to working are as follows:—

Statement of Coal Used, &c.

Description of Coal.	In Store Dec. 31, 1900.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store June 30, 1901.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common . . .	303,085	872,057	980,643	2,556	191,943
Cannel	13,302	12,335	*11,431	..	14,206
Total . . .	316,387	884,392	992,074	2,556	206,149

* In addition to this quantity of cannel, 6,341,449 gallons of oil and spirit were used during the half year.

Statement of Residual Products.

Description.	In Store Dec. 31, 1900.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1901.
Coke—tons	59,071	601,706	139,483	449,707	71,587
Breeze—tons	3,916	82,639	13,477	62,929	10,149
Tar—gallons	1,183,996	9,780,405	10,148,372	19,091	796,938
Ammoniacal liquor—butts	21,300	256,816	263,685	..	14,431

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps.
	Public Lights and Under Contracts. (Estimated.)	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
* 11,607,710	522,715	10,274,155	10,954,321	51,048
† 12,040,775	535,868	10,716,358	11,415,779	51,996

* Including 1,874,004,000 cubic feet of "oil gas." † June half year, 1900.

The last statement is the general balance-sheet. It shows that the value of the stores on hand on June 30 last was as follows: Coals, £218,807; oil and petroleum spirit, £138,136; coke, £54,795; tar and ammoniacal liquor and products, £100,569; sundries, £274,279—total, £786,586. The figures for the corresponding period of 1900 were: Coals, £96,510; oil and spirit, £39,265; coke, £18,693; tar, &c., £99,007; sundries, £238,697—total, £492,172. The item "automatic meter supplies (balance of fittings account)" amounts to £195,945, as compared with £254,191 at the close of the six months ending June 30, 1900.

DEVONPORT GAS COMPANY.

The Sale of the Undertaking to the Corporation.

The Fifty-seventh Annual Meeting of the above-named Company was held at the Offices, in Devonport, last Tuesday—Mr. ALBERT BENNEE in the chair.

The Directors, in their report, expressed regret that, owing to the high cost of coal and freights, and the greatly reduced price of coke, the results of the year's working had not been of the usually favourable character. The total revenue for the year was £45,911, compared with £39,312 in the preceding twelve months; showing an increase of £6599. The total expenditure for coals, wages, maintenance, taxes, rates, and other incidental expenses, amounted to £46,308, compared with £36,510 before. The balance to the credit of the net revenue account brought forward, with the interest on the reserve fund, amounted to £6921; and, after payment of the dividends authorized at the last annual meeting, there remained £3575, out of which the declaration of the usual dividends was recommended. The plant and works had had the careful attention of Mr. S. E. Stevenson, the Company's Engineer. Regret was expressed at the death of Mr. R. Clarke, the former Engineer to the Company, and of Mr. J. W. Honey, one of the Directors. With reference to the arrangement for the sale of the undertaking to the Corporation, the report stated as follows:—

Your Directors notified you by circular, dated May 4 last, of their having entered into an arrangement with the Corporation for the sale of the property. The heads of the agreement are shortly as follows: The price to be paid by the Corporation for the undertaking to be settled in case of disagreement by arbitration under the Lands Clauses Acts. The maximum dividends on all shares to be deemed the dividends for calculating the value of the property. The Company to retain their reserve fund of £5000, and to pay thereout the whole of their costs. Your Directors do not consider it discreet to enlarge further at present.

The CHAIRMAN, in moving the adoption of the report, said that comparison of the various items of the accounts with those of the previous year, as had been customary in the past, was rendered difficult because of the very different form in which the accounts were presented. In consequence of the decision of the Court of Quarter Sessions on the petition presented against the Company in December last,* they were compelled to adopt the form of accounts attached to the Gas-Works Clauses Act, 1871. Previous to the presentation of the petition, they were advised that it was not necessary to do so. Other companies were similarly situated, and the question had been decided both ways under the Local Acts. Among others, the Walsall, Leamington, and Hanley Gas Companies had been attacked as they were; and some of them had come off victorious, while others had fallen before the Corporations. The capital shown in the balance-sheet as £63,625 2s. 5d., was made up thus: Plant and works, £55,302 14s. 11d.; meters, £6501 14s. 4d.; and automatic meters, £1820 13s. The last item was previously shown in the suspense account; but it was now included in the capital and works. Another sum of £4000 for the purchase of the freehold, shown in the balance-sheet last year, still remained a separate entry. Last year they spent £1712 on automatic meters and fittings, and other expenditure on new buildings, plant, mains, and service-pipes brought up to £79,799 16s. 6d. the total outlay on capital account. On the other side, they had the original 7000 shares of £5 each, representing £35,000, and 3000 guaranteed shares of £5 each, representing £15,000—making together £50,000; while, in addition, there were debenture bonds £14,800, or £200 less than the authorized issue. They raised the price of gas 6d. per 1000 cubic feet from the 1st of June last year; but he told the shareholders then that, having regard to the increased cost of coal, this would not recoup them more than half the additional outlay. They had hoped to be recouped to some extent by getting a better price for coke; but the advance in the price of this residual had a very short life. Tar and sulphate of ammonia yielded about the normal results. They had been as economical as, under the circumstances, they could. They were bound to keep the whole of the works in as thorough a state of repair as possible, so that there might not, through any neglect of theirs, be any loss when the time came for the valuation to be made by their own and the Corporation valuers. In the year ended May 31, 1900, they laid out £6161 on the repair and maintenance of works and plant; and last year they spent £4417. On the maintenance and renewal of mains and service-pipes, the expenditure was £304, against £1056; while the repair, renewal, and fixing of meters cost £434, against £617. Rates showed an increase of £81; and the income-tax for the first half year was £131 more. As, unfortunately, the shareholders knew, the Company had no longer to pay income-tax. They had, however, a new item, in the form of £21 12s. 6d. for the insurance of their employees under the Compensation Act. The management charges were £1402, against £1706. Interest on debentures amounted to £511, as compared with £539; the reduction being due to the fact that the rate of interest was reduced from 4 to 3½ per cent. On the other side of the account, they had £34,007 from the sale of gas, against £27,505; meter-rentals, £949, against £916; and from the sale of coke, £8789, against £8463. With regard to their appeal to Parliament, the shareholders were all aware of the result; and he did not think it was necessary to say much about it. They failed, not from want of witnesses of the very best kind, but from the fact that there was what was termed an illegal issue of shares in 1853. The Directors were very anxious to secure the holders of those shares against any loss that might have accrued from the issue. If they had failed to get their Bill or to come to terms with the Corporation, they would have lost at least £25,000; and, considering the possibility of this loss being incurred, the willingness of the town to purchase the property, and the terms which the Corporation were induced to offer, the Directors thought it undesirable to run the risk. Apart from the legality of the issue of those shares, they had not a shadow of a doubt that their case was such that they would have obtained the new Act; and their shares, which were now quoted at from £11 10s. to £12, would in a couple of years have advanced to £17 or £18. But there was the rock on which they struck; and they considered it advisable to make the best terms they could with the Corporation. What those terms were, he did not think it would be wise to say at present. Having regard to the delicacy of the negotiations that would yet have to take place before the whole affair was settled, and the extreme reticence of the Council and their officials, they could not do better than keep their own counsel.

Mr. G. BUCKTHOUGHT said that under their Act of Parliament the Company had power to borrow £15,000. What was the meaning of an overdraft of £27,000 at the bank, and where was the authority for this loan? Had the Directors given their individual guarantee to the bank, or mortgaged the property of the Company?

The CHAIRMAN said these were unwise questions, and, though there was a perfect answer, he considered the inquiry very indiscreet.

Mr. BUCKTHOUGHT remarked that if the Directors went outside their Act of Parliament, they were liable to the shareholders. Did the law costs mentioned include the whole of the charges, or would there be any more, and, if so, up to what date were the costs paid?

The CHAIRMAN replied that undoubtedly there would be a further account.

Mr. BUCKTHOUGHT asked another question as to the right of shareholders to inspect the books; and, as one who had had experience as a director of companies, he expressed surprise that the minutes of the last annual meeting had not been read.

Mr. W. H. BLIGHT reminded the Directors that five years ago he

* See "JOURNAL," Vol. LXXVII., pp. 148, 1004.

objected to the payment of income-tax by the Company. If they had then gone into the matter, they would have seen that the shareholders ought to pay the tax. It was the same with the accounts. Two or three years ago, he asked for a more detailed statement of the working of the undertaking, as well as the expenditure on it. They had such a statement now; but it was like locking the stable door after the horse was stolen. It had been stated in the papers that one of the servants of the Company was to get a pension. They had a large number of old servants; and he hoped that, in the transfer, these would not be forgotten.

The CHAIRMAN, replying to the questions, said Mr. Buckthought appeared to consider the letter rather than the spirit of Acts of Parliament. In carrying on gas, water, and other undertakings, it was an ordinary thing for them to occasionally have accommodation from their bankers. They could not carry on business always without an overdraft. A good deal of the money mentioned was borrowed to carry on the business; but a sum of £14,000 or £15,000 had been spent on new plant, for which the Corporation would pay when they took over the works. The Corporation would not only pay the value of the undertaking, but 10 per cent. for compulsory purchase; so that he did not think they had made a bad bargain by overdrawing at the bank. The law costs had been paid up to the 30th of April; and there would, of course, be more. But the Directors, though very much badgered and fiercely attacked, did not have their eyes shut when before Parliament; and one of the items of agreement with the Corporation was that the Company should have the reserve fund of £5000 with which to pay the costs. He thought they were fortunate in this respect. Shareholders could, of course, examine the accounts. The minutes were not read because it was not the Company's custom; their practice having been to read and confirm the minutes at the next Board meeting after the annual meeting. He did not think it would be fair to the bankers to say what the rate of interest on the overdraft was; but it was a fair and legitimate charge. The question of the treatment of the old servants was one for the consideration of the shareholders. When they knew what money they had to divide, they could give what they pleased to their old servants.

A SHAREHOLDER asked if it was true, as reported, that the Chairman of the Company was to receive a pension of £150 a year.

The CHAIRMAN replied that there was no arrangement whatever between the Corporation and the Company on the matter. As General Manager, he had a perfect right not only to what the Corporation had given him, but to more. Had he studied his own interests instead of those of the shareholders, he should have asked for what was invariably given—namely, seven years' commutation for what he was getting; but he did not do so. He gave strict instructions to their Solicitor and Agents not to consider him in the least; and no one was more surprised than he was to find what had been done. Certainly, he should have asked for compensation when the time came; and had he asked for seven years' commutation, he would have got £400, or its equivalent £16 or £18 a year, more than he would receive now.

After some further discussion, the report and accounts were adopted with one dissentient.

The usual dividends were declared, and power was given to the Directors to pay the interim dividend for the half year ended Nov. 30, should the Company then be in existence.

The retiring Directors were re-elected; and the Directors, officers, and staff were thanked for their services.

YORK UNITED GAS COMPANY.

The half-yearly report of this Company shows the balance of revenue account, carried to profit and loss, amounts to £2548, and when to this amount is added £238 interest from the reserve fund, the total profit for the half year is £2786. Of this sum £185 has been paid for the half-year's interest upon money borrowed on mortgage; leaving £2601 available for dividends, amounting to £6999—showing that the profit falls short of the amount required by £4398. But, as was stated in the last half-yearly report, this deficiency was fully anticipated by the Directors, and can be again taken from the unappropriated surplus profits of previous years reserved for that purpose. The Directors recommend that the usual maximum dividends be declared. The financial position of the Company is somewhat exceptional, for while the recent abnormally high prices of coal and oil have caused the price of gas all over the country to be raised, the Company, so far, have been enabled to carry on their business without making any alteration in the scale of charges, which still range from 1s. 8d. and 1s. 9d. to 1s. 11d. per 1000 cubic feet. At the close of the ordinary meeting, the shareholders will be asked, at a special meeting, to carry out the consolidation of the 10 per cent., 5 per cent., and 4 per cent. shares by authorizing the issue of certificates of a uniform 4 per cent. stock, as sanctioned by the Company's last Act of Parliament.

Droitwich Gas Supply.—The Manager of the Gas Department of the Droitwich Corporation (Mr. S. G. Askew) has presented to the Fire and Lighting Committee his report on the working of the gas undertaking in the past year. The quantity of gas made was 17,337,000 cubic feet—an increase of 2,160,900 cubic feet, or 14·23 per cent., on the previous year. The quantity sold to private consumers was 11,807,800 cubic feet—an increase of 1,001,500 cubic feet, or 9 per cent., against 18 per cent. The comparatively mild winter largely accounted for this. The number of consumers increased by 25. The total number of cookers out on hire is 112—an increase of 29 for the year. The total receipts amounted to £3379, or £532 more than before. The amount received for residuals represents 58 28 per cent. of the cost of coal; being an increase of 6·68 per cent. The total expenditure amounted to £2792, being an advance of £554, mainly owing to the increased cost of coal (£482 13s. 9d.) and rates and taxes (£56 11s. 10d.). The summary of the year's working is: Receipts, £3379; expenditure, £2792—leaving a credit balance of £587.

SULPHATE OF AMMONIA COMMITTEE.

Fourth Annual Report.

The Executive Committee of the Sulphate of Ammonia Committee have submitted to the subscribers their fourth annual report. It is signed by the Chairman (Mr. W. G. Blagden), and is accompanied by an account of receipts and expenditure for the financial year ended the 30th of June last, and an estimate of expenditure to Dec. 31 next. In the course thereof, they state as follows:—

The agricultural competitions brought to a successful issue during the past season show a further increase on the number carried out in preceding years, the total for the year under review being 77, or 8 in excess of the previous year. The results of these competitions have been in every sense highly satisfactory; and this remark equally applies to the competitions for the prizes which the Committee again offered at the Scottish National Fat Stock Club Show in Edinburgh and at the Brewers' Exhibition in London. The full report on these competitions, with the tabulated results, is in course of preparation, and will be issued at an early date.

During the past season, grain trials in which sulphate of ammonia and nitrate of soda were carefully compared, were carried out under the supervision of Mr. Hunter. The trials are being repeated this season on a more extended scale; and it has also been arranged that Mr. Hunter shall conduct some cattle-feeding experiments, with a view to demonstrating the superiority of turnips grown with the aid of sulphate of ammonia over those grown with the aid of other nitrogenous manures.

The Committee's report on the competitions carried out during the 1899 season was issued early in September, and 70,000 copies were printed. Of this number, upwards of 36,000 copies were taken by subscribers for distribution in their respective districts. The balance, with the exception of 5500 copies which were kept in reserve, were circulated in those districts untouched by individual subscribers.

In December it was decided that the Sulphate of Ammonia Committee should be represented at the Glasgow International Exhibition; and a Sub-Committee, consisting of members residing in the neighbourhood of Glasgow, was appointed, with power to decide on the nature of the exhibit, and to arrange all details in connection therewith. A handsome show-case has been erected in the Agricultural Section, in which are exhibited samples of the various different manufactures of sulphate of ammonia, photographs and specimens of roots, tubers, wheat, barley, oats, &c., grown with the aid of sulphate. A small pamphlet and a leaflet on the use of sulphate of ammonia have been specially prepared, and are being distributed at the Exhibition, together with copies of the Committee's other publications. An attendant with practical experience has been engaged to take charge of the exhibit, and furnish information to visitors.

The Committee's advertisements again appeared in the leading agricultural papers during the first five months of 1901; but they have been discontinued in the provincial newspapers, and the Executive Committee now leave advertising in local papers to the individual subscribers. Owing to the reduction in the outlay on advertising, and to the fact that during the year just ended no new literature has been published, with the exception of the agricultural report and the special pamphlets and leaflets for the Exhibition, the expenditure has been considerably less than in the previous year; and the Executive Committee have found that it was unnecessary to call up more than two-thirds of the subscription of 6d. per ton which they were empowered to levy.

Although there has been no addition to the number of members, the Executive Committee are pleased to report that the quantity of sulphate of ammonia represented by the subscriptions received for the past year shows a substantial increase compared with that of the previous year, the tonnage for the respective periods being—

July, 1899, to June, 1900	110,827 tons.
,, 1900, ,, June, 1901	118,174 ,,
Increase	7,347 tons.

Mr. Francis A. E. Samuelson, of Messrs. Sir B. Samuelson and Co., Limited, of Middlesbrough, has been elected a member of the Executive Committee.

The agricultural competitions are again the most prominent feature of the year's work; and your Committee consider that the splendid results which have been obtained, together with the ever-increasing interest which agriculturists throughout the country are taking in the Committee's experiments, cannot fail to promote a large increase in the consumption of sulphate of ammonia.

THE NEW RETORT-HOUSE PLANT AT CHESTER.

Mr. John West on Encouraging Workmen.

In another part of this issue of the "JOURNAL," there appears an article on "Modernizing the Carbonizing Plant at Chester." The work, as will be seen, is being carried out, under the engineership of Mr. John C. Belton, by West's Gas Improvement Company, Limited, of Manchester. At the close of a meeting of the Directors of the Gas Company last Thursday, there was a little formal inauguration of the plant by the Chairman (Mr. John Gamon), at which his co-Directors were present, Mr. John West (the head of the contracting firm), Mr. Belton, Mr. James Pye, the Secretary, and others. At the entrance to the house containing the gas-engine which drives the coal-breaking and elevating plant, the little party assembled.

Mr. JOHN WEST, addressing the Chairman and his colleagues, said the second moiety of the work with which his Company had been entrusted had been completed in accordance with their contract, and was in readiness for the Chairman to set in operation. As the Board were aware, more than half the work had been finished—that was to say, the first thing that had to be done was to raise the walls of the retort-house,

and supply it with a new roof. This was accomplished last year. Then they had this year taken down half of the old retort-benches, erected new ones with a stage floor, and applied suitable coal-breaking and elevating and charging and drawing machinery; and this had been done so that they could start it that day. He believed they had finished the new work earlier than was anticipated. It had been an anxious time both for the Company's Engineer and his firm. He was glad to say, however, they were now relieved from further anxiety; and the Directors would also be relieved when he told them that the whole of the new work was now in such a state that they could begin to make gas with it as soon as they wished to, or as soon as their Engineer felt that the settings were sufficiently dry for the purpose. The whole of the work had been carried out without accident, and, he believed, with satisfaction to all concerned. The completed half, being the first, had, of course, been the most difficult part to carry out; but there would be no difficulty in finishing the second half in accordance with the contract. The whole of the material was on the works, only waiting for the time when Mr. Belton could see his way clear to shut down the remaining old section of the house. He expressed his gratification to the Directors that they had been pleased to place the work in the hands of his firm. The price of coal, which had been a disturbing element in the gas industry, had also disturbed the iron market; and had caused some difficulty to contractors in carrying out their work. He acknowledged the assistance which his firm had received from the Company's officials, and then said that they had felt they would like to inaugurate the change to modern appliances by asking the Chairman to open the door of the engine-house with a key which he hoped he would accept as a souvenir of the occasion, and then to set the machinery in motion. He concluded his remarks by wishing the Company increased prosperity under their new system of manufacture.

Mr. West handed the Chairman a beautifully designed gold key, in a case, plush covered and lined with satin. The key was inscribed with these words: "Presented to John Gamon, Esq., on the Occasion of the Starting of West's Stoking Machinery and Regenerator Furnaces at the Chester Gas-Works, 25th July, 1901."

The CHAIRMAN, in acknowledging the gift, said he should like to say that it was to him, and, he was sure, to his fellow-Directors, a most gratifying announcement that Mr. West had made, that the whole of the work would be completed before the end of the time stipulated in the contract. He (the Chairman) had been to the works frequently during the execution of the first part of the contract; and he must say that the work had gone forward with the most business-like alacrity. He had found, when any delay had taken place, that it had been easily explained, and he was satisfied Mr. West had used his best efforts to complete the works in a first-rate manner, and so that the manufacture of gas should be commenced as provided in the contract. The greatest diligence had certainly been used. He must also recognize the honour which Mr. West had done him in allowing him (as he said) in a formal manner—he (the Chairman) looked upon it as being rather a splendid manner—to open the new section of the works. The Directors believed that with the apparatus they now possessed, they would not only manufacture gas to the full amount they needed, and which they were very much in want of, but they would be able to produce it with still more economy. The contract was put into the hands of Mr. West's Company without asking other firms to tender for the work. The Directors had received such a high character of the firm and of the work they turned out, that they felt they could not do better than trust the whole matter to them; and he had confidence that at the end of the work, they would be well satisfied with it.

The Chairman then opened the door of the engine-house with the key presented to him by Mr. West; and by simply pulling an endless chain attached to the shafting, he set the whole of the coal-breaking and elevating machinery in motion. The crushing and raising of the coal to the hoppers was then witnessed. An examination of the furnaces followed; and then ascending to the stage floor, a demonstration was made with the manual drawing and charging machinery. From the coal breaking to the charging of a retort, the whole machinery worked with the utmost smoothness, and to the satisfaction of all who witnessed it.

Mr. WEST subsequently said that he must thank the Chairman for the kind expressions used towards his firm, and to say that they were grateful to the Board for giving them the work. He had confidence in saying that the results which had been indicated would be realized; and there was no need for anxiety on that score, as Mr. Belton had made up his mind that the apparatus should be used in a scientific manner. With the Chairman's permission, he should like to say a few words on another topic. As an old gas engineer, he was very much interested in the relations of employers and labour. He should like to say to the Chairman personally and to the Directors—in reference to the important scheme which they had carried out in connection with their men—that it was high time employers endeavoured to do something to make their men work more harmoniously and with better heart than some of them did at present; and any scheme which would bring this about should have their sympathy. He had read about the profit-sharing scheme which had been adopted by the Directors; and he believed it would work to the interest of both the Company and the men—the men especially. He was glad to learn that the men had acquiesced in the proposal without bringing in their leaders. Not that he objected to trade unions if they were properly governed; but, as a rule, he had not found that they were properly governed. In his own case they had to do with the great engineering strike; and he could assure those present that before it took place, they were simply living in a state of purgatory. Since the strike, his firm had endeavoured to do what the Chester Gas Company were doing; they had tried to encourage the men by giving them a bonus, but not exactly in the same way. However, since they had introduced it, the firm had received every encouragement from the men, who now appeared to be very happy. If things had gone on much longer in the way they were doing, it would have meant ruin to the men individually, and to the engineering trade throughout England. Indeed it was really necessary the strike should take place to level matters. He congratulated the Directors upon their action, which had attracted to them the attention of the whole of the gas world. They were following somewhat on the same lines as Mr. G. Livesey's profit-sharing scheme; and as an old gas engineer, who had had a large number of men at work under him, he was sure the scheme would be a great boon to both the Company and the men. If they could get their men to work with them, it must tend to the benefit of their concerns. In business enterprises, employers and employed should be one. Therefore he congratulated the Directors upon bringing about what he conceived was a proper thing for every gas company in the United Kingdom to adopt.

The CHAIRMAN thanked Mr. West for his congratulations, and for the intelligent remarks he had made on the subject. He observed that he was bound to say, on the part of the Company's men, that there had been no trouble at all; and no pressure had been put upon anyone in connection with the scheme. But a favourable opportunity arose for introducing it; and it was indeed a great pleasure to him and to his co-Directors that they were able to adopt it, as it was for the benefit of the men. But the Directors did not pretend to say, as he told the men themselves, that it was entirely for their benefit; it was also for the stability of the Company, for the better working of the whole establishment, and for the economy which would be produced, in all of which the shareholders and gas consumers would participate.

Refreshments were served in the office; and shortly afterwards the little party separated.

SWADLINCOTE GAS AND WATER SUPPLY.

At a meeting of the Midland Counties District members of the Association of Municipal and County Engineers, held at Swadlincote on the 20th inst., under the presidency of Mr. E. G. Mawbey, Borough Surveyor of Leicester, Mr. T. Kidd, the Surveyor and Water-Works Engineer to the Swadlincote Urban District Council, read a paper on the public works of the town, in the course of which he dealt with the gas and water undertakings. In regard to the former, he stated that the gas-works were purchased by the Council in 1898, the cost being as follows: Award of Sir G. R. Bruce, £34,219; miscellaneous expenditure, £3405—total, £37,624. The cost of the Act of Parliament was £1370. The works have been enlarged since they were taken over by erecting a new scrubber, washer, condensers, and purifiers, capable of dealing with an output of 250,000 cubic feet of gas per day, and other distributing plant and appliances, at a cost of £8840. Therefore the cost of the works up to March 31, 1901, stands at £47,834. At the present time the author is engaged in carrying out the erection of a new retort-house and coal-store, &c., estimated to cost £2000; Mr. Alfred Colson, of Leicester, being the Consulting Engineer. When the Council acquired the works, the quantity of coal carbonized was 2773 tons, and of gas made 24,997,800 cubic feet, of which 18,109,700 cubic feet were sold; the total sales amounting to £4739. In the past financial year, 3913 tons of coal were carbonized, and 35,247,000 cubic feet of gas made, of which 26,669,300 cubic feet were sold; the total sales amounting to £7338. In 1897-8, the sales by ordinary meters came to £3399; and by prepayment meters to £153. Last year the figures were £4279 and £1050. The loss of gas by leakage is very high. When the works were taken over, it was equal to 26 per cent. of the make. It has, however, been reduced to 23 per cent. The water supply is derived from the Milton watershed, and, after being pumped into the Woodville reservoir, gravitates into the Swadlincote district—the consumption for the year ending March 31, 1900, being 67,612,000 gallons, equal to an average of about 10 gallons per head per day. Consumers may be supplied and charged on the rateable value of the premises, or by meter at a fixed minimum price. At present there are upwards of 500 meters of various sizes in use. Since 1898, the water-mains have been extended in order to cope with the needs of the district. In the discussion upon the paper, several speakers alluded to the high percentage of loss of gas by leakage; and Mr. Kidd explained that it was due to mining operations—the district being in one part literally pulled to pieces by them.

ELECTRIC LIGHTING NOTES.

The full force of a severe thunderstorm was felt in Chester last Friday night. During a heavy peal, all the electric lights in the Town Hall were extinguished.

In a return recently placed before the Cardiff Electrical Committee, it was shown that the total sum paid by the Committee in wages and salaries on the electric lighting undertaking was £2756, which is 23·87 per cent. of the total revenue.

The receipts of the Leigh Corporation Electricity Department last year amounted to £1187, and the expenditure to £1288—leaving a loss of £101 for the year. As an inducement to the inhabitants to become consumers, the Committee have decided to allow a discount of 10 per cent. for payment of accounts within fourteen days after demand. In face of this report, it is rather peculiar to find the Committee recommending the Council to apply for £11,250 to carry out extensions of the electricity works. However, the Council have given their consent to the application.

A report is in circulation to the effect that a new disease has been discovered by Dr. Defontaine, an eminent physician of Paris, which affects all, in varying degrees of severity, who work under a strong electric light, or in buildings where electric furnaces are employed. In one instance which came under the notice of the Doctor, where an arc light was used—its estimated power being 100,000 candles—a workman, although protected by dark glasses, in a short time began to suffer from symptoms resembling sunstroke. The retina of the eye was so affected that he began to lose his sight, and was quite unable to restrain a continuous flow of tears. He also suffered from severe headaches and sleeplessness; and ultimately his skin began to peel off. Several cases of eye affection caused through electric "sunstroke" have, the report says, been treated in the English hospitals; and it is stated that many, especially office clerks, suffer from a slight form of the disease without being materially inconvenienced.

An inquiry was held in the Town Hall, Buxton, on Tuesday last, by

Mr. M. K. North, Assoc.M.Inst.C.E., in regard to sanction to borrowing, for the purpose of electric lighting, a sum of £25,000. Mr. Josiah Taylor (Clerk to the Council) said the population of the town was 10,179, the assessable value £89,879, and the outstanding loans £47,000. Mr. E. Calvert, the Electrical Engineer, said that last season, with 4500 lamps connected, they had a load of 126 kilowatts, being approximately 3500 lamps alight, or four-fifths of the total lamps connected. They had 10,000 lamps on the books, which in the same ratio—viz., four-fifths alight at once—would give them a load of 8000 lamps, or equal to 285 kilowatts. They were not in a position to deal with such a load with their present plant, the maximum output of which was 190 kilowatts with all their machinery at work, and the safe working load only 120 kilowatts. He impressed upon the District Council the urgency of their immediately installing new machinery to meet the demand. It was proposed to expend £16,520 at once, and the balance of £8440 would soon be required. There was no opposition.

In the report of the Electricity Committee of the Manchester City Council for the year ended March last, it is stated, among other matters, that the number of consumers at the close of the year was 3790—an increase of 550 on the previous year. The total number of lamps connected was: Incandescent (8-candle power) 279,860, and arc 2316, compared with 237,145 and 2139 respectively. In addition to these, there were 672 motors in use, representing 6560-horse power; being an increase on the preceding year of 172 motors, equivalent to 4510-horse power. The total output of electricity from the works during the twelve months amounted to 9,639,973 units. The quantity measured and accounted for was 7,944,540 units; showing a loss of 1,695,433 units, or 17·58 per cent., due to leakage in distribution. There was a net profit on the year's working of £3515 10s. 6d. This surplus, *plus* the amount withdrawn from the reserve fund (£484 9s. 6d.), makes up the sum (£4000) paid to the city fund in aid of the rates. The following statement shows the financial position of the undertaking at the 31st of March last: Total capital expenditure, £863,293; mortgage debt, £722,273; amount of mortgages redeemed to date by the action of the sinking fund, &c, £67,837; balance at the credit of the reserve fund account, £13,172. Since the appointment of Dr. Kennedy, in January last to design and equip the Stuart Street generating station and the various sub-stations connected with it, for the first installation of 15,000-horse power, rapid progress has been made. Tenders have been accepted for the whole of the engines, generators, boilers, &c., required for this installation; and it is expected that a proportion of the plant will be erected and ready to supply current by May 31, 1902. At the Bloom Street station, the iron and steel work of the first pair of boilers and a portion of the first engine and generator are now in position. Tenders have been obtained to the specifications of the Chief Engineer (Mr. G. F. Metzger) for the plant required to complete the equipment of these works, and it is anticipated that one set of generating plant will be in readiness for the output of electricity at the beginning of October, to assist in meeting the heavy demands for current during the winter. Applications from new customers cannot be considered until the Committee are advised that this station can be made available for next winter's work. Upon the completion of the work at the Stuart Street and Bloom Street stations, the Committee will be in a position to provide the energy required for working most of the tram routes which the Tramways Committee are preparing to work electrically in May next year, and also to furnish an efficient supply of current to several of the out-districts whose Electric Lighting Orders have been taken over by the Corporation.

The report of the Electricity Supply Committee of the Birmingham Corporation sets forth that, owing to the necessity of making provision for the development of the department, and in view of the probable need of electric energy for tramway purposes, the Committee purchased the site of the old Birmingham General Hospital, at £23,000, for a generating station. They instructed their Engineer to prepare plans and report upon the equipment of the station, so as to meet the requirements of the Tramways Department and the probable extension of lighting in the near future. They were informed by him that the erection of an adequate power station and the instalment of the machinery would take at least two years. There was, therefore, no time for delay in going into the matter. The site upon which it is proposed to erect the necessary buildings has an area of 19,409 square yards, and the ultimate cost of the works when the site is fully utilized is estimated as follows: Twelve combined engines and dynamos, £79,500; boilers and economizers, £24,000; condensing apparatus, including pumps and exhaust-pipes, and pipe connections between the canal and the pumps, £8860; steam piping, feed connections, and exhaust arrangements in engine-room, £12,000; coal-handling plant, £6300; water-tanks and water-softening plant, £6100; switchboards, balancers, transformers, and accumulators, £22,300; crane, £1400; main buildings, including shedding over canal, cooling-tanks, &c., £74,500; architect's commission and clerk of works' salary, £4200—total, £239,220. The whole of the power with which the station will ultimately be equipped will not be required for some years. For the present, it is only proposed to provide for 5000-horse power, which will supply the necessary energy for the tramway system, and for an extension of lighting mains, as may be required, to the length of about 15 miles. The supply of outlying districts will require to be supplemented by subsidiary stations. The Engineer estimates the cost of laying the new mains and of the subsidiary power stations at £75,000. To properly work the generating station, it will be necessary to practically complete the scheme of buildings; but the machinery can be put down from time to time as needed, and four sets of engines, one-fourth of the boiler equipment, and a portion of the condensing plant, will be sufficient as a first instalment of the work. The cost of this work is estimated at £128,890. In order to admit of the Corporation being in a position to work tramways by the beginning of 1904, the equipment of the station must be commenced at the earliest possible date; and they recommend that the Council should authorize the carrying out of the first instalment of the work, the laying of the mains referred to, and the construction of the subsidiary stations, at the cost stated.

A Local Government Board inquiry was held at Burnley last Thursday respecting an application by the Corporation to borrow £20,000 for gas-works purposes and £11,000 for electric lighting.

MANCHESTER CORPORATION GAS SUPPLY.

Annual Report and Accounts.

We have received from the Superintendent of the Manchester Corporation Gas Department (Mr. Charles Nickson) a copy of the report of the Gas Committee, briefly noticed last week, with an abstract of the accounts for the year ending March 31 last. The Committee record the progress of the undertaking as follows:—

The number of tons of coal and cannel carbonized, including the equivalents of enriching materials, and quantity of gas and residual products made per ton carbonized, compared with the previous year, is—

	Coal and Cannel Carbonized. Tons.	Gas per Ton. Cub. Ft.	Coke per Ton. Cwt.	Coke for Sale per Ton. Cwt.	Tar per Ton. Gallons.	Am. Liq. per Ton. Galls. (10 oz.)
1901.	459,811	10,298	12·77	8·83	12·40	28·86
1900.	458,273	10,312	12·65	8·49	12·21	26·74

The quantity of curburetted water gas produced during the year was 676,303,000 cubic feet, compared with 564,661,000 cubic feet in the previous year. In the production of this gas, 2,464,607 gallons of oil and 14,550 tons of coke were used, compared with 2,122,163 gallons and 11,584 tons respectively for the year ended March 31, 1900.

The illuminating power of the gas sent from the works was equivalent to 18·97 standard sperm candles, against 19·40 candles for the previous year.

The quantity of gas transmitted from the works shows an increase of 7,981,000 cubic feet, or 0·17 per cent., compared with an increase of 268,771,000 cubic feet, or 6·03 per cent., in the year 1899-1900. The total output and quantity unaccounted for, compared with the previous year, is as follows:—

	Gas Sent Out. Cub. Ft.	Unaccounted For. Cub. Ft.	Percentage of Loss.
1901	4,733,825,000	130,761,000	2·76
1900	4,725,844,000	164,065,000	3·47

The number of gas consumers on March 31, 1900 and 1901, was respectively as follows:—

	Within the City.	Beyond the City.	Total.
1901	107,604	25,485	133,089
1900	102,668	23,523	126,191
Increase in 1901.	4,936	1,962	6,898

The percentage of private consumption was as follows:—

	1900. Per Cent.	1901. Per Cent.
Within the city—Ordinary consumers	79·45	78·67
Prepayment ,,	4·79	5·42
Outside the city—Ordinary ,,	15·39	15·41
Prepayment ,,	0·37	0·50
	100·00	100·00

The number of prepayment meters in use at the end of the financial year was 35,818, compared with 31,436 in the previous year—an increase of 4382, of which 3715 have been fixed in the city and 667 in the out-townships. The quantity of gas consumed by these meters was 251,342,000 cubic feet—an increase of 37,245,000 cubic feet, or 17·39 per cent. These meters were inspected once in every five weeks, and the amount collected from them during the year was £35,144 7s. 3d. This amount is represented by 8,434,647 pennies, weighing 75 tons 6 cwt. 21 lbs. The number of silver coins in the meters during the year was 2151 florins and 215 half-crowns. One half-sovereign was found in a meter. There were also found 443 bad or foreign coins or checks, which, for the most part, were exchanged for pennies by the consumers at the time of inspection.

The number of gas fires, cookers, and other appliances on hire on the 31st of March was 12,085, and the number of gas-engines in use 1604, compared with 9560 and 1488 respectively for the year ended March 31, 1900. The quantity of gas used by cookers, fires, and engines is estimated at 405,000,000 cubic feet; being an increase of 15·71 per cent. on the previous year's figures.

During the past three years, the increase in the consumption of gas has been as follows:—

	Cubic Feet.	Increase Per Cent.
Year ended March, 1899	303,553,000	7·31
Do. 1900	268,771,000	6·03
Do. 1901	7,981,000	0·17
Average	193,435,000	4·66

The price of gas was advanced, by resolution of the City Council, by 3d. per 1000 cubic feet from and after June 24, 1900. This advance has added £40,594 to the income of the department, but has retarded the increase in the consumption by 6 per cent. The total amount of revenue was £724,463, compared with £654,527 in the year 1899-1900; being an increase of £69,936. It was derived as follows:—

	1900.	1901.
Gas-rentals, &c., within the city	£433,843	£479,993
Do. beyond the city	88,979	100,151
Coke	64,927	86,096
Tar	34,533	27,826
Ammonia water	31,436	29,408
Sundry receipts	809	989
	£654,527	£724,463

The amount paid for coal, cannel, and oil, including the cost of unloading, was £318,568. The cost of material per ton carbonized was 13s. 10·28d., against 11s. 0·54d. for the previous year—an increase of 2s. 9·74d. per ton, which on the total carbonization of 459,811 tons amounts to £64,642.

The gross profit on the year's working was £130,405 4s. 10d. The sum of £40,233 15s. 11d. was paid for interest, and £37,421 15s. 8d. has been placed to the sinking fund (as required by the Acts of Parliament under which the money is borrowed). The net profit, therefore,

amounted to £52,749 13s. 3d. Of this amount, £51,900 was paid over to the city fund, and the balance of £849 13s. 3d. has been applied in the extension of the carburetted water-gas plant.

The expenditure on capital and renewals accounts was as follows:—

	Capital.	Renewals.
Gaythorn	£2,020 10 3	£2,171 2 9
Rochdale Road	1,853 10 11	5,988 11 2
Bradford Road	28,401 18 9	162 10 0
Street-mains stores—		
Poland Street	7,936 18 8	16 17 6
Whitworth Street	861 1 6	—
Mains	8,475 7 6	6,303 14 1
Services	6,980 18 6	4,099 18 2
Meters	19,014 6 4	10,448 2 11
Stoves	15,433 7 1	560 2 0
Stoves show-room (Deansgate)	14 13 0	—
Oil Storage Depôt (Mode Wheel)	481 16 4	—
	£91,474 8 10	£29,750 18 7
Less—Transfer to Rochdale Road renewals account—value of station meters and gasholder removed	4,000 0 0	—
	£87,474 8 10	£29,750 18 7

The following extensions and renewal of works were carried out during the year:—

Gaythorn Station.—In the No. 1 retort-house, nine beds of inclined retorts were renewed on a different plan from the original arrangement, and have worked satisfactorily and justified the alterations. The same construction will be applied to the remaining nine beds to be renewed this season. The store-room adjoining the exhauster-house has been adapted as an extension of the house, and the exhauster, of a capacity of 160,000 cubic feet per hour, transferred from the Bradford Road station fixed therein. The purifier in the "A" section, damaged by fire in November, 1899, has been repaired and put to work. In "B" section the centre-valves have been overhauled and refaced, and new covers have been fixed on the purifiers in "C" section. The new scrubbing and washing plant continues to work satisfactorily, and a contract has been placed for the extension of the condensing plant which will further assist the working of this apparatus.

Rochdale Road Station.—In addition to the usual renewals of retorts, the following work has been carried out at this station: The offices for the foremen, which form the first section of the work under the reconstruction scheme for this station, have been built by the Committee's own staff. These offices will be of much service in more efficiently controlling and carrying on the work of the various departments; the building at the same time giving a generally improved appearance to the works at that point. A portion of the foundations for the new store-rooms and joiners' shop has been constructed, and the erection of the superstructure will be proceeded with as soon as it is practicable to remove plant which is still working on the site of these buildings. The No. 4 gasholder has been taken down, and good progress made with the foundations for the new set of purifiers to replace the "A" section. This work has necessitated the removal of the benzol-storage tank, which has been placed in a safe position in the works. The new mechanics' shop and smithy were completed during the year and occupied by the workmen. The suitable machinery and tools in the old shops have been removed there, together with the addition of new plant.

Bradford Road Station.—The drawing-machines in the retort-houses have been fitted with motors for propelling the machines along the house by power instead of by manual labour. The whole of the retorts are now charged by machinery, instead of a portion by hand labour as formerly. This enables the work to be carried out more efficiently, and eases the labours of the men. An additional line of rails has been laid through the yard, which facilitates the distribution of the coke to the stores and the carburetted water-gas plant. During the year this station has been equipped with wood-working machinery, to avoid the necessity of taking this class of work to the Rochdale Road station. Stables for the accommodation of 15 horses have been provided, and will shortly be ready for occupation. Good progress has been made with the erection of the experimental gas-works, which will be ready for use during the ensuing winter. The works are being equipped with apparatus of the most modern description, and the experiments carried out will be a guide to the various stations, both as regards the selection of the most suitable material for gas making and the method of working to be employed to ensure the best results.

Carburetted Water-Gas Plant.—The new section of carburetted water-gas plant of a capacity of 3½ million cubic feet, erected by Messrs. Humphreys and Glasgow, is completed; and during the summer the subsidiary plant, consisting of frictional scrubbers and additions to the cooling and tar-storage tanks, will be constructed. The new boiler-house for this plant, containing a set of six boilers, is completed. An oil-storage tank of a capacity of 278,786 gallons has been added this year, making the total oil storage capacity at this station 557,572 gallons. There has also been added a station meter of a capacity of 150,000 feet per hour for registering the gas made in this section.

Sulphate of Ammonia and Sulphuric Acid Plant.—The foundations for this plant have been constructed by the Committee's own staff; and though considerable difficulties were met with, owing to the nature of the ground, the work has been carried out without accident. Good progress has also been made with the erection of the buildings and apparatus, and the plant is expected to be ready for work within the stipulated contract period.

Oil Storage Station, Mode Wheel.—A building, comprising messroom for the carters engaged in carting oil to the Bradford Road station, and for the use of the crews of the vessels bringing the oil, together with an office for the foreman in charge, has been erected at this station.

Droylsden Station.—At this station there has been no constructional work carried out or alterations effected in the plant. The ordinary

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 271.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 12	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7⅓	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	July 1	5	Australian 5 p.c. Deb.	100—102	..	4 18 0
200,000	5	May 15	6½	Bombay, Ltd.	6—6½	..	5 0 0
40,000	5	,,	6½	Do. New, £4 paid	4¼—4½	..	5 9 5
380,000	Stk.	Feb. 14	12	Brentford Consolidated	260—265	..	4 10 7
270,000	,,	,,	9	Do. New	190—195	..	4 12 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	128—132	..	3 15 9
159,375	,,	June 14	4	Do. 4 p.c. Deb.	111—114	..	3 10 2
220,000	Stk.	Mar. 14	10	Brighton & Hove Orig.	222—227	..	4 8 1
226,320	,,	,,	7	Do. A. Ord. Stk.	155—160	..	4 7 6
1,022,500	Stk.	Feb. 27	5	Bristol, 5 p.c. max.	121—123	..	4 1 4
420,000	20	Mar. 28	10	British	41—42	..	4 15 3
50,000	10	Feb. 28	12	Bromley, Ord. 10 p.c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p.c.	19—21	..	4 5 8
500,000	10	May 31	6	Buenos Ayres (New) Ltd.	8¾—9¼	..	6 9 9
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	94—97	..	4 2 6
150,000	20	July 17	8¼	Cagliari, Ltd.	22—24*	..	6 17 6
100,000	10	May 31	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
550,000	Stk.	Apl. 12	12	Commercial Old Stock	270—280	..	4 5 9
236,425	,,	,,	9	Do. New do.	205—210	..	4 5 9
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	128—133	..	3 7 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	158—163	—2	5 10 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	158—163	—2	4 5 11
575,000	Stk.	Feb. 28	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
486,090	10	July 17	10½	European, Ltd.	19—20*	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15*	..	5 5 0
15,079,885	Stk.	Feb. 14	4 7/10	Gas-light and Coke 4 p.c. Ord.	94—96	..	4 11 8
2,600,000	,,	,,	3½	Gas-light and Coke 3½ p.c. max.	90—92	..	3 16 1
3,799,735	,,	,,	4	Gas-light and Coke 4 p.c. Con. Pref.	109—112	..	3 11 5
4,063,425	,,	June 14	3	Gas-light and Coke 3 p.c. Con. Deb.	91—93	..	3 4 6
70,000	10	May 31	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	May 15	10	Imperial Continental	207—210	..	4 15 3
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Feb. 28	10	Liverpool United A	235—237	..	4 4 5
678,100	,,	,,	7	Do. do. B	172—176	..	3 19 7
306,083	,,	June 28	4	Do. do. Deb. Stk.	118—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd.	4¼—5	..	4 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	105—108	..	4 12 7
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	103—105	..	4 5 9
541,920	20	May 31	3½	Monte Video, Ltd.	9—10	..	7 0 0
717,946	Stk.	Feb. 22	8½	Newc'tle & G'tesh'd Con.	230—231	..	3 13 7
312,855	Stk.	June 28	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd.	7¼—7⅝	..	5 3 3
135,000	5	,,	8	Do. New, £4 10s. pd.	6⅛—6⅜	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅝	..	4 11 5
					*Ex. div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 28	7	Ottoman, Ltd.	5⅜—6¼	..	5 12 0
851,070	10	Apl. 26	7	River Plate Ord.	10⅝—11¼	..	6 4 5
250,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Mar. 28	8	San Paulo, Ltd.	10⅛—11⅛	..	6 19 1
135,000	Stk.	Mar. 14	10	Sheffield A	235—240	..	4 3 4
209,984	,,	,,	10	Do. B	235—240	..	4 3 4
523,498	,,	,,	10	Do. C	235—240	..	4 3 4
5,761,885	Stk.	Feb. 14	5	South Met., 4 p.c. Ord.	125—128	+½	3 18 2
1,547,965	,,	July 17	3	Do. 3 p.c. Deb.	90—93*	—1	3 4 6
380,940	Stk.	May 15	5	Southampton Ord.	106—111	..	4 10 1
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109*	..	3 13 5
120,000	Stk.	Feb. 28	6	Tottenham and Edmonton A. 5 p.c.	115—120	..	5 0 0
250,520	,,	,,	4½	Tottenham and Edmonton B. 3½ p.c.	85—90	..	5 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Feb. 28	9	West Ham, 10 p.c.	9—10	..	4 10 0
147,000	10	,,	6	Do. 7 p.c.	11¾—12½	..	4 16 0
128,984	Stk.	June 28	4	Do. 4 p.c. Deb.	103—108	..	3 14 1
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord.	285—290	..	3 15 10
150,000	,,	,,	5	Do. 5 p.c. Pref.	150—155	—3	3 4 6
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	137—140	..	3 4 4
175,785	,,	Mar. 28	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Apl. 12	7	East London, Ord.	187—192	..	3 12 11
654,740	,,	June 14	4½	Do. 4½ p.c. Deb.	143—148	..	3 0 10
980,169	,,	,,	3	Do. 3 p.c. Deb.	94—96	..	3 2 6
700,000	50	June 14	8	Grand Junction 10 p.c. max.	102—105	..	3 16 2
310,000	Stk.	Mar. 28	4	Grand Junction 4 p.c. Deb.	123—127	..	3 3 0
708,000	Stk.	Feb. 14	14	Kent	280—290	..	4 16 7
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—205	..	3 8 4
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max.	260—270	..	3 17 9
406,200	100	,,	8	Do. 7½ p.c. max.	200—205	..	3 18 1
350,000	Stk.	Mar. 28	4	Do. 4 p.c. Deb.	123—126	..	3 3 6
500,000	100	Feb. 14	13¾	New River, New Shares	395—400	..	3 8 9
1,000,000	Stk.	Jan. 31	4	Do. 4 p.c. Deb.	127—132	..	3 0 7
902,300	Stk.	June 14	6	South-wark and Vauxhall Ord.	172—177	..	3 7 9
126,500	100	,,	6	South-wark and Vauxhall 7½ p.c. max.	162—167	..	3 11 10
489,200	Stk.	,,	5	South-wark and Vauxhall 5 p.c. Pref.	147—152	—3	3 5 9
1,019,585	,,	Apl. 12	4	South-wark and Vauxhall 4 p.c. A Deb.	123—128	..	3 2 6
1,155,066	Stk.	June 14	10	West Middlesex	260—265	..	3 15 6
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	138—143	..	3 2 11
200,000	,,	Mar. 14	3	Do. 3 p.c. Deb.	95—98	..	3 1 3
					*Ex. div.		

repairs have been made to the retorts, and tapered inclined retorts erected. The purified ammonia plant continues to work satisfactorily, reducing the impurities to a minimum.

Street Mains and Lighting Department.—During the past year the mains and services have been kept in good condition, and the new 24-inch mains in Ducie Street, Greenheys, now approaching completion, will give an abundant supply of gas during the next winter to the Rusholme and Victoria Park districts. The 30-inch and 36-inch independent mains now in full working order have been of great value in equalizing the pressure generally. The total length of mains now laid is 1,430,900 yards, or 813 miles and 20 yards; being an increase of 10¾ miles and 341 yards during the year. The new stables, workrooms, and offices reported last year as in course of erection at Poland Street are now nearing completion, and will in the course of a short time be ready for occupation for lamp repairs, meter repairs, meter storing, cleaning and repair of gas-cookers, and pipe testing and cleaning. There is a convenient workmen's dining-room, and the stables will provide accommodation for twelve horses. The new storage-sheds at Whitworth Street are also approaching completion. An installation of intensified gas lighting has been placed on the Infirmary Esplanade, consisting of nine lanterns, seven of which are fitted with 4-light, and two with 3-light clusters of burners. There is also one burner fixed in the underground lavatory. The total consumption of gas by the 35 burners is 350 cubic feet per hour; and the illuminating power claimed per cubic foot of gas consumed is from 30 to 35 candles. Taking the lower figure, this gives an illuminating power of 10,500 candles for the installation. The gas is supplied to the burners at a pressure of 8 inches of water, or about four times the ordinary pressure in the street mains. This increased pressure is obtained by the aid of a Keith compressor, which is actuated by the city water supply. The working of the compressor is entirely automatic, and requires no attention; the lighting and extinguishing of the lamps regulating its working. Meters have been fixed to register the consumption of gas and water, so that the exact cost of the lighting will be ascertained and fully reported in due course.

Stoves Department.—The following is a summary of the year's transactions, compared with the previous year:—

	1900.	1901.
Number of articles sold	941	1320
New stoves purchased for hire	2477	2546
Stoves issued on ordinary hire (including new stoves and re-issues)	4367	4678
Stoves issued on the hire-purchase system	22	21
Stoves cleaned and repaired	1350	1869

The whole of the works and plant have been kept in good repair and working condition throughout the year, out of revenue.

Accompanying the report are the accounts and the usual appendices, from which we take the accompanying particulars.

REVENUE ACCOUNT.

INCOME.

Gas-rental—		
Ordinary meters		£496,581 10 7
Prepayment meters		35,144 7 3
Public lamps		42,280 10 10
Stove-hire		6,137 16 11
Residual products—		
Coke	£86,096 4 0	
Tar	27,826 5 3	
Ammonia water	29,407 13 8	
Carbon	554 0 8	
		143,884 3 7
Rents of cottages, &c.		434 18 6
		£724,463 7 8

EXPENDITURE.

Cannel, coal, and carburine (including cost of unloading, &c.)	£274,876 6 6
Carbonization (retort men's wages, &c.)	50,427 13 7
Retorts, fire-bricks, &c. (including cost of setting)	15,551 0 2
Repairs and maintenance of works, mains, &c.	71,298 17 7
Renewals of plant, &c.	29,750 18 7
Purifying material and wages	4,871 16 6
Carburetted water gas	57,658 7 8
Salaries and wages of clerks in Superintendent's office, rental and inquiry offices, and meter inspectors	28,507 13 2
Collectors', receivers', and cashiers' salaries	9,542 16 10
Rents, rates, and taxes	43,042 17 4
Compensation under Workmen's Compensation Act, 1897	256 6 0
Bad debts written off	1,258 12 5
Miscellaneous expenses	7,014 16 6
	£594,058 2 10
Balance	130,405 4 10
	£724,463 7 8

PROFIT AND LOSS ACCOUNT.

Interest	£40,233 15 11
Sinking funds	37,421 15 8
Balance (net profit on the year's working)	52,749 13 3
	£130,405 4 10

The balance of net profit is applied as follows:—

Amount paid over to the city fund account	£51,900 0 0	
Balance placed to carburetted water-gas plant account	849 13 3	
		£52,749 13 3

The appendices following the accounts furnish, as usual, statistics as to the progress of the gas undertaking during the year.

Appendix A is a comparative statement of the gas transmitted from

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000

	Cubic Feet Daily.
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

ORDERS RECEIVED IN 1901 TO MARCH 1 . . . . 3,500,000 CUB. FT. DAILY.

the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows :—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1901. .	1,367,193,000 ..	4,733,825,000
Do. do. 1900. .	1,322,308,000 ..	4,725,844,000
Increase . .	44,885,000 ..	7,981,000

Loss (by condensation and leakage), 130,761,000, or 2·76 per cent.

In Appendix B, particulars are given as to the results of the working from June 24, 1881, to March 31, 1901. The table contains statistics as to the number of tons of coal carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., for each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 459,811 tons; gas made, 4,735,300,000 cubic feet; yield per ton of coal carbonized, 10,298 cubic feet; illuminating power, 18·97 candles; make reduced to 20-candle power, 4,491,432,000 cubic feet; make per ton, 20-candle power, 9768 cubic feet; make of coke, 252,970 tons; do. per ton of coal, 12·77 cwt.; make of tar, 27,452 tons; do. per ton of coal, 12·40 gallons; make of ammoniacal liquor (10-oz. strength), 11,433,824 gallons; do. per ton of coal, 28·86 gallons.

Appendix C shows the number of stoves on hire and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 7804 stoves on hire within, and 4281 beyond the city—together, 12,085, compared with 6375 and 3185 (together 9560) at the corresponding date in 1900; so that there was an increase of 2525. The number of meters in use was 133,089 in 1901 and 126,191 in 1900. There was last year a net increase of 6898 on the number for the preceding year. Of the total number at work on March 31 last, 127,496 were on hire, as compared with 119,967 at the close of the financial year 1899-1900. The number of prepayment meters on hire on March 31 last was 35,818—an increase of 4382 on the number at the close of the preceding year.

From Appendix D, we learn that the gas-mains laid last year within the city extended to 18,408 yards, and beyond the city to 11,916 yards —a total of 30,324 yards, or 17 miles 404 yards. The mains taken up were 9015 and 2048 yards respectively—a total of 11,063 yards, or 6¼ miles 63 yards. The total net increase during the year, therefore, was 19,261 yards, or 10¾ miles 341 yards. The total length of mains laid up to March last was 1,430,900 yards, or 813 miles 20 yards.

Appendix E consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from 1862 to March 31 last. The figures for the past financial year are as follows: Profit, £130,405; paid over for improvement purposes, £51,900; transferred from contingent fund, £22,887; borrowed money owing, £1,162,925; and excess of assets, £1,165,148. The profit of £130,405 is appropriated thus: Interest, £40,234; liquidation of mortgage debt, £37,422—leaving a surplus of £52,749.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Looking back upon the meeting of the North British Association on Thursday, there can, I think, only be one feeling—satisfaction that so creditable a show was made. In a year when there is to be a congress of overwhelming dimensions—also held in Glasgow—it might have been that the North British meeting would have suffered, as it did in 1885, when the meeting of the Gas Institute was held in Edinburgh. But, neither in point of attendance nor in the proceedings was there any such thing. The attendance was larger than ever; and the proceedings were such as any Association might be proud of. It would be painting the lily, to say the President was all that could be desired. Everyone knew he would be. That he was so well supported by the members, must be matter of gratification to him.

There will be a sense of thankfulness generally that the end has at last been reached of the movement for the standardizing of meter-unions. The subject has been dealt with in languid fashion—as, indeed, it behoved to be, seeing that only managers of small works had any interest in it. In a large works the number of meters in use makes interchangeability a small matter. It is rather a question of inconvenience to the workmen, who may have to make two visits instead of one, than of cost to the department. In a small works, it is otherwise. Many a time a meter would be changed but for the fact that the union does not fit it, and it would cost money to put on an appropriate union. The question now is, What would be done with the standard which has been adopted? If meter makers put no other on the market, gas managers will be obliged to use the standard sizes; but the Board of Trade can scarcely order them to be employed, to the exclusion of all others. If there should be a manager with a whim to the effect that the recognized unions were not suitable for his gas, who is to forbid him having special sizes made for himself? He would, of course, pay more if he did than if he took that which everyone else was taking; and probably the question of cost will settle the matter generally.

The paper by Mr. Yuill should help forward the practice of enriching by benzol. There appears to have been much ignorance on the subject, even as to where and how to apply the enricher; and in the case of Mr. MacPherson, of Kirkcaldy, there is rooted disbelief in the process altogether. He will not be convinced; but those who were in quest of information, will find in Mr. Yuill's statements, and in the discussion which followed the paper, much that will be of benefit to them, if they should resolve to adopt the system.

It looked as if Professor Ivison Macadam's lecture would be delivered to empty benches. The meeting was three hours old when the discussion upon enrichment terminated. It was then put to the members whether they would adjourn, as is the usual practice, or go on; and they resolved to go on. Having so resolved, the members immediately proceeded to adjourn—upon the principle, I suppose, that one's neighbour should remain. As a matter of fact, an adjournment was made;

WELSBACH

SELF-INTENSIFYING KERN BURNER

Giving a Lighting Efficiency of 300 CANDLES PER BURNER with about 10 Cubic Feet of Gas

AT ORDINARY PRESSURE.

Dispensing entirely with Auxiliary Compressing Plant of any kind whatever.

Specially Suitable for Lighting Large Areas.

The most Economical and Efficient System on the Market.

The Welsbach Shadowless Lantern, with Self-Intensifying Welsbach-Kern Burner

FOR FURTHER PARTICULARS APPLY TO THE

WELSBACH INCANDESCENT GAS-LIGHT CO., Limited,

PUBLIC LIGHTING DEPARTMENT, YORK STREET, WESTMINSTER. LONDON, S.W.

and then the members came back in numbers nearly as great as before. Those who were absent missed a treat.

The paper by Mr. Creeke disclosed an ingenious endeavour to improve and cheapen the cost of gas purification; and it received very favourable consideration. The only regrettable feature of the meeting was the absence of so many distinguished sons of the Association, with regard to which there will, I believe, be general agreement that the loss was theirs as much as the Association's.

The accounts of the Glasgow Corporation Gas Department for the year ending May 31 have been made up, and will be considered by the Gas Committee at their next meeting. The result, as has been foreshadowed, is disappointing; there being a deficit of about £55,000. Nothing like this has ever happened before, the largest deficit ever experienced having been £27,000 in 1891 2. The unfortunate result is due to the high price of coal, which cost £130,000 more than in the preceding year, and to the decrease in the returns from residuals, amounting to about £7000. A year ago, the price of gas was raised from 2s. 2d. to 2s. 6d. per 1000 cubic feet, by means of which £80,000 was added to the revenue. It is felt that to have charged 2d. more per 1000 cubic feet would have been advisable. The belief is entertained that, as it is, in order to wipe out the deficit, the price of gas will be retained at 2s. 6d., notwithstanding that coal has been contracted for at an average of 5s. per ton less than was paid last year. Of course, the Committee have to consider this question; and they may possibly be of opinion that to retain the price at 2s. 6d. per 1000 cubic feet for the whole year would lead to the earning of a surplus larger than they desire, and in the course of the year they might make a reduction so as to bring the accounts nearer to a square. In Glasgow 1d. per 1000 cubic feet of gas produces about £20,000 a year; so that the £80,000 which would be realized would far more than wipe out the £55,000. Of course, it is not to be lost sight of that at present coke is falling in price; and the revenue from it, if the price remains low, will be less. The Committee erred a year ago, in contracting for coal for the whole year at a high figure; and the natural tendency, in such circumstances, is to go to the other extreme. This has to be guarded against. Everyone will be glad to see the balance adjusted, which it is likely to be a year hence.

The annual meeting of the Stirling Gas Company was held on Tuesday. It was reported that a sum of £17,000 had been spent in reconstructing the works, of which £4500 had been debited to revenue, and a further sum of £500 has still to be, in terms of the Company's Act. During the past year, the quantity of gas made was 89,100,000 cubic feet, an increase of 5,108,000 cubic feet on the preceding year. Since 1896, the increase in the gas made has amounted to 26,500,000 cubic feet. This increase has been largely due to the introduction of gas stoves and cookers, of which there are now 280 in use; an addition during the year of 131. Prepayment meters are also increasing in number; there being now 660 of them in use, from which a sum of £832 was derived in the course of the year. During the year about ¾ mile of additional mains were laid. The dividend paid was the usual one of 7s. per share, which is said to be a good deal more than 7 per cent. This is the undertaking which the Corporation were afraid to take over lest it should prove a losing adventure. It is better for the shareholders that their property was not taken from them; but those who were instrumental in defeating the transfer, must now be chagrined beyond measure when they consider what folly they were the means of perpetrating.

The Bo'ness Gas Company have paid a dividend of 5 per cent., and have reduced the price of gas from 3s. 9d. to 3s. 4d. per 1000 cubic feet. This week, at a special meeting of the Town Council, Mr. Calder gave notice of a motion to the effect that a Committee be appointed to look into the matter of the lighting of Bo'ness. He asserted that the price charged for gas, compared with towns of similar size, is too high; and his opinion is that, if satisfactory terms cannot be arranged with the Gas Company, the Town Council should correspond with the Kitson or other Company as to the public lighting of the town. I do not know where Mr. Calder gets his information; but I have looked into the matter, and find that 3s. 9d. per 1000 cubic feet is the general price in all the towns which are comparable with Bo'ness. In fact, the only exceptions are: Gourock, where the price is 3s. 6d.; Kelso, 3s. 6½d.; Peterhead, now 3s. 8d (till a fortnight ago, 4s. 3d.); and Selkirk, 3s. 1½d. Of course, what rouses the ire of Mr. Calder and any followers he may have is that in Alloa, a few miles distant, gas is being sold at 2s. 4d. per 1000 cubic feet.

The report of the Directors of the Huelva Gas and Electricity Company, Limited, which was approved at the recent annual meeting, sets forth that the sales of gas show an increase of 6·85 per cent. in quantity and 4·83 per cent. in cash receipts. The sales of electricity show an increase of 27·4 per cent. in cash receipts. The net profit for the year was £1217, compared with £1590 for the year 1899-1900; the decrease being very much more than accounted for by the extra cost of coal and freight. The Directors recommended a dividend of 2½ per cent.

The Gas Committee of the Dunfermline Corporation on Tuesday considered the subject of the price which they are to charge for gas during the current year. The Engineer (Mr. A. Waddell) estimates that 3s. 6d., which is a reduction of 5d. per 1000 cubic feet, would leave a surplus of more than £2000. Some of the Committee considered that there should be a reduction of 7d. The Auditor (Mr. R. Cockburn Millar) was present; and he supported Mr. Waddell's view. The Committee were unable to come to a decision; and the matter will be reported to the Town Council.

I omitted to mention last week that a few days before then a most disastrous explosion of gas occurred in a corn mill in Stockbridge, Edinburgh, by which a great deal of damage was done to property, and nearly twenty people were injured—five of them fatally. A gas-engine was being taken out by the employees of a firm of engineers; and, in connection with the work, an escape of gas occurred. A report by experts is being prepared, which may decide how the disaster was brought about.

In the matter of public lighting, the pendulum has taken three swings, to my knowledge, in Edinburgh. First, Sir T. J. Boyd, when Lord Provost, in order to save money, induced the Council to agree to one-

RICHMOND'S (STRATFORD) FIRE BRIGADE.

half of the lamps being put out at midnight. This lasted for a dozen or more years; and then Bailie Macpherson, aghast at the opportunities which were given by the darkness for the commission of crimes, persuaded the Council to allow the whole of the lamps to be kept alight till morning. Now, this week, in considering the estimates for public lighting, and with a view to keeping down the cost, the Council, on the suggestion of Mr. Menzies, have resolved that all the lights in common stairs be extinguished at midnight, and that such public lamps as the Inspector of Lighting may consider it possible to dispense with, be similarly dealt with. By this means, in the months of August and September, it is estimated, there will be a saving of £400 or £500. It did not seem to occur to anyone that a great deal more might be saved if the electric lighting of the streets were cut down. The twelve o'clock rule cannot be applied to them, because it is already the practice to extinguish half of the electric lamps at midnight.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 27.

Sulphate of Ammonia.—The firmer tone at the close of last week has developed into a larger demand, more especially on the East Coast, and prices have improved all round; the closing quotations being £10 10s. per ton f.o.b. Hull, and £10 12s. 6d. f.o.b. Liverpool and Leith. Continental buyers, who have for some time been consistently holding aloof, have found themselves obliged to come on to the market; and this demand, with requirements for covering July contracts, has brought about the improvement—available supply being now only a limited quantity. There has also been considerable buying for August delivery, at the different ports, at a premium on spot prices; and £10 17s. 6d. per ton is reported paid f.o.b. Leith for delivery October forward.

Nitrate of Soda is steady at 8s. 9d. to 8s. 10½d. per cwt., according to quality, on spot. In the forward position, the market is quiet; but holders are very firm, and indifferent about selling.

LONDON, *July* 27.

Tar Products.—Business in tar products is generally quiet, with the exception of benzol, in which a fair amount of transactions have taken place. Sales of 90 per cent. were made at 9½d. for prompt shipment, while 10½d. has been paid for September-December, f.o.b. London; but 50-90 per cent. are neglected, and there are sellers at 9d. out-ports, although 9½d. London has been declined. There is really nothing doing in solvent for export, although the demand for home consumption continues fairly good, especially as regards London. For anthracene, the price is purely nominal, no transactions having taken place, though several manufacturers would like to clear out their stocks before the winter. The market for carbolic is very depressed, principally owing to the offers of crystals which are being made by London dealers, who are willing to accept 7¾d. for 39-40's, October-December delivery. Sales of crude 60's are reported at 2s. 1d. and 2s. 1½d. for August shipment. Pitch is still firm, especially in South Wales, where fuel makers appear to be short of stock. Tar oils are certainly easier, particularly in the North of England, where there are several large parcels offering. Tar continues in good demand. Prices which have in some instances recently been paid are not at all likely to prove remunerative to the tar distiller.

The average values obtaining during the week are: Tar, 14s. 6d. to 17s. 6d. Pitch, east coast, 30s. to 31s.; west coast, 28s. to 28s. 6d. Benzols, 90's, 9d. to 10d.; 50's, 9d. to 9½d. Toluol, 10½d. Crude naphtha, 4¼d. Solvent naphtha, 1s. Heavy naphtha, 11d. to 1s. Creosote, 1⅛d. to 1⅜d. Heavy oils, 2¼d. Carbolic acid, 60's, 2s. 1d. to 2s. 1½d. Naphthalene, 60s. to 70s.; salts, 30s. to 40s. Anthracene, "A," 2¼d. to 2½d.; "B," nominal.

Sulphate of Ammonia.—The market is decidedly firm. The Gaslight and Coke Company will not reduce their price of £10 15s., and appear confident of realizing same at an early date. Another of the principal gas companies have declined £10 12s. 6d. for August, after having accepted this price for a small quantity for July shipment. In Leith, business is reported at £10 12s. 6d.; and one Company are stated to have refused this price for August shipment. There is a fairly good demand at Hull; and makers now ask £10 10s. to £10 12s. 6d. for August shipment. In Liverpool, there is very little business to report; but prices are well maintained.

COAL TRADE REPORTS.

Lancashire Coal Trade.—Although the recent spell of exceptionally hot weather has thrown a good deal of round coal on the market, prices have not been appreciably affected, except where clearance lots have been pushed for prompt sale at special prices. It would now seem more than probable that round coal prices have pretty well touched the minimum for the summer. Certainly colliery owners disavow any intention of a further official reduction, as any extra stocks that may be accumulating will, they anticipate, be fully required for the ensuing winter. As regards gas-making coals, all that can be stated is that the various contracts are gradually being settled, and on pretty much the same basis as reported of late. Here and there concessions on the stringent regulations enforced last year by the coalowners have been necessary; but, as a rule, there has been very little trouble as to the conditions of contracts, and reductions of about 3s. 6d. per ton on unscreened and 2s. 6d. to 3s. on screened coals seem to have fairly met the situation. Average quoted prices remain at about 10s. per ton at the pit for unscreened qualities, 10s. 6d. to 10s. 9d. for medium screened coals, and 11s. to 11s. 3d. for best screened gas coals. Nothing further has been done with respect to locomotive fuel contracts in this district; the coalowners declining to entertain the prices which railway companies have been offering. It has been left for Derbyshire to cut in at the very low figures. In steam and forge coals, contracts for works continue to be settled at about 9s. to 9s. 6d. per

"EUREKA"

POPULAR WITH THE GAS MANAGERS.

POPULAR WITH THE CONSUMERS.

Telegrams: "EUREKA," BIRMINGHAM.

ton at the pit; while for shipment, with so much surplus coal recently on the market, clearance sales have been made at below these figures, ranging from 10s. and 10s. 3d. up to 11s. and 11s. 3d., delivered at the Mersey ports, for ordinary steam coal. House-fire qualities are without quoted change; local coalowners not attempting to compete with the temporary low prices at which cheap surplus output from other districts is offering. At the pit, basis list rates remain at 15s. per ton for best house coal, 13s. to 13s. 6d. for seconds, and 11s. to 11s. 6d. for common house-fire descriptions. Engine fuel, owing to the lessened production of slack, is maintaining a rather stronger position. No real advance on late rates has been obtained; but there is a check to further downward movements, and fewer cheap special lots are offering on the market. The immediate outlook is perhaps rather uncertain, as a good deal of slack will, during the next few weeks, be thrown on the market, owing to the holiday stoppages of works and mills; but with the improvement in the coke trade, there is the probability of more slack being taken off the market for this purpose. For the present, prices at Lancashire collieries are steady at 6s. to 7s. per ton for inferior sorts, and 8s. to 8s. 6d. for the best qualities of slack. Coke remains strong, with a tendency to harden in qualities suitable for iron-making purposes. At the ovens best Lancashire foundry cokes range from 24s. to 25s. per ton, best washed Lancashire furnace cokes from 13s. to 13s. 6d., good washed Yorkshire furnace cokes from 12s. up to 13s., and common unwashed cokes from about 10s. 6d. to 11s. 6d.

Northern Coal Trade.—There is a strong demand; and this and the rather short supply, are forcing up the prices for occasionally needed lots. The short supply is believed by some to be due to restriction of the output on the part of the miners. Best Northumbriam steam coals are 13s. to 13s. 6d. per ton f.o.b., and steam smalls are 5s. to 5s. 6d.; the demand for the former class being especially good. In gas coals, there is a full demand, due to larger exports, in part, as some of those who have contracts wish to press forward the shipments during the time the rebate of the tax is allowed. There is also a larger shipment now to some of the great users of gas coals, so that the chief collieries are well employed. Prices are on the basis of 10s. 6d. to 10s. 9d. per ton for occasional cargoes; while for contracts the general price is on the basis of 9s. per ton f.o.b. or thereabouts. In the coke trade, the demand during the past few days has been moderately steady; and the price is 17s. to 18s. per ton f.o.b. for best Durham qualities for export purposes. Blast-furnace coke is quoted 15s. to 15s. 6d. per ton at the furnaces. Gas coke shows no alteration of moment, either in demand or price.

Scotch Coal Trade.—Trade is brisk, after the holidays in the West; but the temporary improvement in the demand has not had the effect of sending up prices, which may be quoted as follows: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. to 10s. 3d. The shipments for the week amounted to 124,922 tons—a decrease of 90,817 tons upon the previous week, and of 20,685 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,188,507 tons—a decrease of 637,715 tons upon the same period of last year.

Public Lighting by Welsbach Burners and Lanterns.—The Welsbach Incandescent Gas-Light Company, Limited, have received an order for 423 Putney and Kingston lanterns, with No. 4 Kern burners, for the borough of Wandsworth, and also for 800 No. 3 burners for the Willesden Borough Council.

West Bromwich Tradesmen and the Cost of the Electric Light.—As the result of the recent deputation of West Bromwich tradesmen to the Electric Lighting Committee of the Corporation (*ante*, p. 233), the Committee have decided to reduce the charges for electricity by 4d. per unit for the remainder of the summer season.

Littlehampton Gas Company.—At the ordinary general meeting of this Company on the 7th prox., the Directors will report an increase of 3,988,110 cubic feet of gas sold in the past financial year, compared with the twelve months ending June, 1900. The total revenue was £7536, and the expenditure £5968; leaving a balance of £1568 to go to the profit and loss account. The amount available for distribution is £1656; and the Directors recommend dividends at the rates of 5 and 3½ per cent.—making, with the interim dividends, 10 and 7 per cent. per annum respectively. The Directors express their gratification at being able to do this without having raised the price of gas, notwithstanding the increased cost of coal. The works, which are under the supervision of Mr. A. W. Elton, were considerably improved during the year; a sum of £7123 having been expended on capital account.

Ripon Gas-Works Finances.—Considerable warmth was introduced into a meeting of the Ripon City Council on Monday last week, when the subject of the gas-works finances was under discussion. Mr. Moss pointed out that during the last four years the gas account had been reduced from a credit balance of £21 18s. 10d. to a deficit of £2025 2s. 4d., and this notwithstanding a great increase of trade. There was no return for the expenditure of £17,000. He moved the appointment of a Special Committee to consider the matter. Mr. Walker seconded the motion, and described the report as showing absolute failure. Alderman Kearsley thought that in the expenditure of the £17,000 they had practically renewed the gas-works. Alderman Lee, Acting Chairman of the Gas Committee, denied the charge of failure; and eventually it was agreed to leave the matter with the Gas Committee.

New Joint-Stock Companies.—The Kitson Lighting Company of Great Britain, Limited, has been formed with a capital of £250,000, in £1 shares, "to acquire from the Kitson Lighting and Heating Syndicate, Limited, the benefit of certain patents relating to lighting and heating and the undertaking of the Syndicate; to acquire any other inventions; and to carry on the business of suppliers of light and heat, manufacturers of lamps, stoves, and lighting and heating apparatus, electrical and general engineers, contractors, promoters, &c." The Coventry Lighting and Engineering Company, Limited, has been formed with a capital of £15,000, in £1 shares, to acquire the business now carried on by the Coventry Gas-Fitting, Electrical, and Engineering Company, Limited, at Coventry, Rugby, and Nuneaton, to adopt a certain agreement, and to carry on the business of gas, electrical, pneumatic, hydraulic, and general engineers.

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Tar-Distilling Plants. **Claus' Sulphur-Recovery Plants.**

SULPHATE OF AMMONIA PLANTS.

The Cost of the Newcastle Holder.—A correspondent has raised a question as to the total cost of the new 5½ million cubic feet holder of the Newcastle and Gateshead Gas Company which we gave in the "JOURNAL" for the 16th inst. as £77,000. It should be explained that this sum is made up of £25,000 for the tank, and £52,000 for the holder, including the work done by the Company.

Colwyn Bay Water Supply.—In consequence of the growth of Colwyn Bay, it has been found imperative to provide a largely increased water supply; and the Conway and Colwyn Bay Joint Water Supply Board have instructed Mr. T. B. Farrington, their Engineer, to prepare plans for an additional 15-inch main, to be laid from the intake chamber near Trefriw across the river along the Denbighshire bank to Sarn Mynach, and thence to Colwyn Bay through Mochdre. The survey is now being carried out.

Finances of Barrow.—The Barrow Corporation accounts for the year ending March 31 show the total amount of money borrowed by the Corporation up to that time to have been £789,794, of which £160,076 15s. 2d. has been redeemed, leaving the present indebtedness of the borough £629,717 4s. 10d. The actual sum redeemed during last year was £10,520 2s. 6d., over and above the interest due. The sum spent on public works is as follows: Gas-works, £104,500; water-works, £256,099 17s. 11d.; electricity works, £37,839 6s. 11d.; other public works, £392,534 18s. 8d.—making a total of £790,974 3s. 6d. The gas and water works transferred a net profit of £6129 to the borough funds in relief of the rates.

Leeds Water-Works Arbitrations.—Colonel W. H. Wellsted has made his award in the recent arbitrations arising out of the compulsory acquisition of land by the Leeds Corporation for water-works purposes in the Washburn Valley. In the case of Mr. Bramley's property, the valuation of the claimant's witnesses amounted to £18,053; while the Corporation witnesses put it at £7874. The Umpire awards the claimant £11,760, apportioned as follows: £5021 for Swinsty Hall, 68 acres of land, and one-fourth undivided share of Swinsty Moor, and £6739 for the remainder of the estate, which consists of three farms containing 148 acres of land. The claim in Mr. Spence's case was for three farms comprising 202¾ acres of land, interference with certain sporting rights, and severance damages to the remainder of the estate. The claimant's witnesses valued the property at £15,587; those for the Corporation, at £5203. Colonel Wellsted has awarded Mr. Spence the sum of £10,659.

York Water-Works Company.—In the report of the Directors of this Company for the past half year, reference is made to the petitions lodged against the Bills promoted by the Leeds, Harrogate, and Ripon Corporations for obtaining water from portions of the Ouse watershed, and it is stated that the water scheme under the Ripon Bill, which was in principle most objectionable, because it proposed to ignore the recognized liability to furnish compensation water, has been withdrawn; Leeds and Harrogate undertaking to provide Ripon with a limited quantity of water on terms agreed upon. It was considered that the provisions inserted in the Leeds and Harrogate Bills protected the interests of the Company and the water consumers. The Directors recommend the following dividends for the past half year: On the preference shares, 1876, at 5 per cent. per annum; on the preference shares, 1896 and 1900, at 3½ per cent.; on the ordinary shares, at 10 per cent.; and on the ordinary shares, 1878 and 1879, at 7 per cent.

Southport Water-Works Transfer.—A special meeting of the share holders of the Southport Water-Works Company was held last Wednesday, at the offices, Southport—Mr. Thomas Bland presiding—for the purpose of considering an agreement for the sale of the Company's undertaking to a Joint Water Board, consisting of representatives of the Southport Corporation, the Birkdale Urban District Council, and the West Lancashire Rural District Council. The terms of the agreement were read by the Secretary (Mr. S. Woodcock), after which a number of questions were submitted for the purpose of eliciting explanations as to the proportionate payments to be made on each class of shares. There are 4000 ordinary and "A" shares of £10 each, 4000 "B" shares, 7000 "C" shares, and 15,000 "D" shares, besides £21,000 of 5 per cent. debenture stock and a balance, according to the last report, of £14,000 odd—making a total capital of £335,069. The ordinary and "A" shares have been earning 10 per cent., and the three other classes 7 per cent.; and the price to be paid—£756,000—represents practically 33½ years' purchase. The holders of both shares and debentures have the option of taking payment in 3 per cent. Corporation stock sufficient to bring in an equivalent of the interest they have been receiving in the past. Some of the shareholders seemed to think better terms might have been secured; but eventually the agreement was accepted unanimously.

The Malton Gas Company have placed with the Economical Gas Apparatus Construction Company, Limited, an order for carburetted water-gas plant to make 150,000 cubic feet per day.

Under the title of "The Progress of Natural Ventilation," Messrs. Robert Boyle and Son, Limited, of 64, Holborn Viaduct, have issued a pamphlet furnishing particulars respecting their system.

The Directors of the Thorn and Hoddle Acetylene Company, Limited, have declared an interim dividend for the past half year at the rate of 6 per cent. per annum, compared with 5 per cent. for the corresponding period of 1900.

Meeting at Leeds last Friday, the shareholders of the Anti-Vibration Incandescent Gas-Light Company declared a dividend of 10 per cent., after the payment of which £1073 will remain to be carried forward. It was reported that the business was being steadily extended.

Mr. W. O. E. Meade-King, one of the Local Government Board Inspectors, held a public inquiry, at Tyldesley, last Friday, into the District Council's application for sanction to borrow £8000 for repairs and extensions of the gas-works, which have been damaged by subsidences.

The Sunlight Acetylene Gas Company lighted for the first time on the 18th inst., the 32 lamps which have just been erected in the streets of Gort (Co. Galway), in order to see how the lights would work. The result was considered to be satisfactory; and the next night all the lamps were lighted at nine o'clock and continued to burn till the early hours of the morning. The cost of lighting the town by this medium is about £750.

At the Bromsgrove Police Court last Tuesday, the East Worcestershire Water-Works Company were summoned for contravening the North Bromsgrove District Council's bye-laws by neglecting to furnish plans of the new pumping-station near Catshill, from which the Company are providing Birmingham with a supplementary supply of water. Mr. H. B. Dain, of Birmingham, admitted a technical offence. A nominal fine of 5s. with 16s. 9d. costs was imposed.

Mr. G. H. Hill has been consulted by the Swansea Corporation in order to obtain his counsel as to the completion of the New Cray water-works, in connection with which they have had such an unfortunate experience. Regarding the point as to whether the work should again be let to a contractor, he says it is possible that tenders might be very limited. For this and other reasons, he recommends the Corporation to do the work by direct administration, saying that, if this course is adopted, he believes it will be more effectively and expeditiously carried out than if let by contract.

Heavy rain fell last Saturday afternoon in the north-east districts of London; and at Hackney Wick the floods which followed were attended by a remarkable and serious result. In White Post Lane, at a naphtha distillery belonging to Messrs. Carless, Capel, and Leonard, the flood water swept into the premises, and filled up the large underground tanks holding great quantities of naphtha, causing this to float away into the adjoining streets. Notwithstanding precautions, a lighted match was thrown down about half-past six o'clock, and an explosion occurred, which caused two deaths and serious personal injury.

Messrs. C. & W. Walker, Limited, have just completed a contract for two purifiers 30 ft. by 25 ft., with 20-inch Weck valves and connections to the existing purifiers, for the Bedford Gas Company. The order for this work, and also for one of Walker's patent purifying machines now being erected, was given to them after full consideration by the Directors. The Company have also recently accepted a further tender from Messrs. Walker for a single-lift gasholder of 500,000 cubic feet capacity, prepared to receive an outer lift in a steel tank 145 feet diameter by 31 feet deep; and one of Walker's complete sulphate of ammonia plants to distil 20 tons of liquor per day. The whole of the work is being carried out under the supervision of Mr. T. Dann, the Gas Company's Engineer.

Speaking at Portsmouth last Tuesday afternoon, at the opening of a fancy fair in aid of the war funds and local charities, Lord Roberts said that, grievous and heavy as was the sorrow which the war had brought upon the country, there was one bright spot, and that was the kindly feeling towards soldiers and their dependents which had been evinced throughout the United Kingdom. The railway companies and many other companies had, at considerable expense, kept open the situations of Reservists, though the men had been absent a great deal longer than was at first expected. The South Metropolitan Gas Company, for instance, had spent £5000 in that way. He was also very pleased to notice the kindly feeling which prompted the fellow working men of the Reservists to help, out of their small earnings, the wives and families of their absent comrades.

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JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

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BANK HOLIDAY.

In consequence of the BANK HOLIDAY (Aug. 5), Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than THE FIRST POST ON SATURDAY.

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Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

STOKER wanted. Used to Scoop. Wages 31s. 6d. Abstainer preferred.
Apply to C. V. BENNETT, Gas-Works, HERNE BAY.

WANTED, at once, a first-class Erector, used to Gasholders and General Constructional Ironwork.
Apply, giving References, Age, and Wages required, to CLAYTON, SON, AND Co., LTD., Hunslet, LEEDS.

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AN important Firm of Gas-Stove Makers are desirous of communicating with any Gentleman who has influence with Gas Companies, with a view to business.
Address No. 3723, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas-Works Fitter, competent to do General Fitting, Main and Service Laying, and Rough Smithing. Wages 5s. per day. Age from 30 to 40.
Apply, by letter, with References, to the MANAGER, Gas-Works, DORKING.

YARM GAS-WORKS.

WANTED, a steady reliable Man as WORKING MANAGER for Small Gas-Works. Must be a good Carbonizer, and understand Regenerator Settings. Able to lay Mains and Services, fix Meters, and make himself generally useful.
Annual make, 5¼ millions.
Apply, by letter, stating Wage expected, with *copies* of not more than three Testimonials (not to be returned).
WM. SELBY,
Secretary.

THE Leeds Fire Clay Company, Limited, require for their Gas Engineering Department a competent Gas Engineer as OUTSIDE REPRESENTATIVE.
Applicants must be competent Draughtsmen and have thorough knowledge of Gas-Works Appliances and Plant, and have had experience in the erection of Inclined Retorts, Conveyors, and Gas Apparatus generally. Liberal Salary to suitable Man.
Apply, in writing, giving full Particulars of past Experience, Age, Salary, and References, to the above COMPANY, 20, Park Row, LEEDS, marked "Gas Engine r."

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WANTED, immediately, an experienced young Man who thoroughly understands Meter Testing and the use of the Photometer.
State Wages required, Age, and Particulars, to No. 3720, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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Apply, by letter, to No. 3725, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, near London, a young active Man as SERVICE LAYER. Must be a thoroughly good Workman in Iron Barrel. Either for Gas or High-Pressure Steam. Wages 7d. per hour. Constant Employment.
Apply, by letter, with References to No. 3726, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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(GAS DEPARTMENT.)

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WANTED, for the above Works, a thoroughly efficient GENERAL FOREMAN. Must be a trained Mechanic, and accustomed to the management of men. Good Wages to a competent Man.
Application to be made on or before the 1st of August in own handwriting, stating Age, Salary required, and giving Particulars of Experience, with *copies* of any recent Testimonials, to the ENGINEER, Gas-Works, Windsor Street, BIRMINGHAM.

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THE Corporation of Congleton are prepared to receive applications for the position of MANAGER of their Gas-Works.
Candidates must possess a practical knowledge of the Manufacture and Distribution of Gas.
Annual make, about 40 million cubic feet.
The person appointed must devote the whole of his time to the duties, and be able to keep the books appertaining to the management, except the gas-rental accounts.
Salary, £130 per annum.
Applications, in Candidates' own writing, stating Age, Training, and Experience, accompanied by *copies* of three recent Testimonials, to be forwarded, on or before the 5th of August, marked "Gas Manager," to
EDWARD A. PLANT,
Town Clerk.
Congleton.

BOROUGH OF ABERAVON.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive APPLICATIONS for the position of ENGINEER and MANAGER of their Gas-Works.
Annual make, about 24 million cubic feet.
Candidates must possess a thorough knowledge of the Manufacture and Distribution of Gas.
The person appointed must devote the whole of his time to the duties, which will include the keeping of all books appertaining to the management.
Age not to be under 25 years, or over 45 years.
Salary at the rate of £2 10s. per week, with House, Coal, Gas, and Rates and Taxes free.
Applications, in Candidates' own writing, accompanied by *copies* of three recent Testimonials, to be forwarded to me, marked "Manager," not later than the first post on Tuesday, Aug. 6 next.
Canvassing will be a disqualification.
By order,
M. TENNANT,
Town Clerk.
Aberavon, July 19, 1901.

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PLEASANTLY situated Furnished HOUSE, opposite Tennis Court, TO LET now. Three Reception and Six Bed Rooms, Bathroom, Servants' Hall, &c., £7 7s. per week one month, £6 6s. two months.
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Apply to the Secretary, THOMAS BEST, Fenny Stratford, BLETCHLEY.

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Six Annular CONDENSERS, 30 feet high. Perfect.
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Other Plant and Sizes in Stock. Photometers, Gauges, &c.
Apply J. FIRTH BLAKELEY & Co., Thornhill, DEWSBURY.

BOROUGH OF LEIGH.
(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for BRICKWORK, &c., required for covering a Tar and Liquor Well, at their Gas-Works.
Specifications and Forms of Tender may be obtained on and after Tuesday, the 30th day of July, 1901.
Sealed Tenders, endorsed "Tender for Covering Tar and Liquor Well," to be sent to me the undersigned on or before Twelve o'clock noon, on Monday, the 5th day of August, 1901.
By order,
PEREGRINE THOMAS,
Town Clerk.
Town Hall, Leigh,
July 25, 1901.

BOROUGH OF LEIGH.
(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the supply and erection of a COKE ELEVATOR.
Specification and Forms of Tender may be obtained from the Engineer, Mr. J. Foster, Gas-Works, Leigh, Lancashire.
Sealed Tenders, endorsed "Tender for Elevator," to be sent to me the undersigned, on or before Twelve o'clock noon, on Saturday, the 10th day of August, 1901.
By order,
PEREGRINE THOMAS,
Town Clerk.
Town Hall, Leigh,
Lancs., July 27, 1901.

STRATFORD-ON-AVON CORPORATION.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of GAS COAL or NUTS of good quality, to meet their requirements for the Twelve Months ending Sept. 30, 1902.

Forms of Tender and full Particulars can be obtained upon application to

J. S. CRANMER,
Manager.

July, 1901.

LITTLEBOROUGH GAS COMPANY.

THE Directors invite Tenders for the supply of 2000 Tons of the best screened GAS COAL, to be delivered at Littleborough Station (L. & Y.), in quantities as required during the period from Sept. 1, 1901, to June 30, 1902.

The Directors do not bind themselves to accept the lowest or any Tender.

Tenders, endorsed "Coal," to be sent in not later than Aug. 6, 1901.

S. E. HALLIWELL,
Manager and Secretary.

Gas-Works, Littleborough,
July 26, 1901.

EAST RETFORD CORPORATION.

TENDERS FOR COAL.

THE Gas Committee of the above Cor- poration invite TENDERS for the supply of 5000 Tons of GAS COAL or NUTS required during the Year ending June 30, 1902.

Tenders, endorsed "Tender for Gas Coal," to be sent in addressed to the Chairman of the Gas Committee not later than Aug. 3, 1901.

The Committee do not bind themselves to accept the lowest or any Tender.

J. B. FENWICK,
Engineer and Manager.

Gas and Water Offices,
Retford, July 22, 1901.

TENDERS FOR GAS COAL.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the supply of 4000 Tons of good GAS COAL (screened or unscreened), to be delivered at the Great Western Railway, Slough, in the usual monthly quantities as may be required during a period of One Year from the 1st of September, 1901.

The Description of the Coal and from what Collieries raised to be stated.

Payment for Coal on or before the 20th of the following month after delivery.

Tenders, to be delivered, endorsed "Tender for Gas Coal," on or before Tuesday, the 13th prox.

The Directors do not bind themselves to accept the lowest or any Tender.

ARTHUR THOMAS,
Secretary.

Slough, Bucks,
July 27, 1901.

BOROUGH OF BATLEY.

TENDERS FOR GAS COAL.

THE Corporation of Batley are prepared to receive TENDERS for the supply and delivery at their Gas-Works of 16,000 Tons of screened GAS COAL.

Conditions and Forms of Tender may be obtained on application to the Manager of the Gas-Works.

Sealed Tenders, addressed to me and endorsed "Gas Coal," to be delivered at my Office by noon on Wednesday, the 7th day of August prox.

The Corporation do not bind themselves to accept the lowest or any Tender, and may accept any Tender for a part only of the specified quantity.

By order,
JOSEPH HANSON CRAIK,
Town Clerk.

Town Clerk's Office,
Batley, July 22, 1901.

LONGWOOD GAS COMPANY.
(INCORPORATED BY ACT OF PARLIAMENT, 1875).

THE Directors of the above Company give Notice that, on the 15th day of August next, they will SELL BY TENDER, 78 NEW PREFERENCE SHARES of £10 each, bearing a fixed preferential dividend of 5 per Cent., and 400 NEW ORDINARY SHARES of £10 each, limited to a Maximum Dividend of 7 per Cent.

Full Particulars and Conditions of Sale may be obtained from the undersigned, to whom Tenders must be addressed not later than the 14th day of August next.

By order of the Board,
JOHN HENRY BREARLEY,
Secretary.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that Otto Schott and the Carl Zeiss Stiftung, sole members of the Firm of Schott and Gen., of Lichtenhainerstrasse, Jena, in the Grand Duchy of Saxe-Weimar, German Empire, have APPLIED FOR LEAVE TO AMEND THE SPECIFICATION OF LETTERS PATENT No. 2679 of 1895, granted to Max Busse, for "Improvements in, and connected with, Incandescent Gas-Burners."

Particulars of the proposed Amendment were set forth in the "Illustrated Official Journal (Patents)" issued on the 17th of July, 1901.

Any person, or persons, may give Notice of Opposition to the Amendment (on Form G) at the Patent Office, No. 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

C. N. DALTON,
Comptroller-General.

URBAN DISTRICT COUNCIL OF ABERTILLERY (MON.).

THE Gas Committee invite Tenders for their surplus TAR for the Year ending Aug. 31, 1902.

The Tar will be delivered in Barrels on Rails at this Station.

Tenders, endorsed "Tar," to be addressed to the Clerk, and delivered not later than Twelve o'clock noon, on the 17th of August next.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
J. M'BEAN,
Manager.

Gas Offices, Abertillery,
July 20, 1901.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street, London, E.C., on Friday, the 16th day of August, 1901, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last, to declare a Dividend for the same period, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 2nd day of August until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
July 30, 1901.

BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Bell Hotel, Bromley, Kent, on Thursday, the 8th day of August, at Six o'clock p.m. precisely, to receive the Report of the Directors, the Balance-Sheet certified by the Auditor to declare a Dividend, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 23rd of July to the 8th of August, 1901, both days inclusive.

By order of the Board,
HENRY W. AMOS,
Secretary.

Offices: 156, High Street,
Bromley, Kent, July 22, 1901.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Offices of the Company, No. 63, Chancery Lane, in the County of Middlesex, on Friday, the 16th day of August, 1901, at Half-past Three o'clock in the Afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year ended the 30th of June last, to declare Dividends, and to transact the Business of an Ordinary General Meeting.

The TRANSFER BOOKS of the Company WILL BE CLOSED from the 2nd to the 16th day of August, both days inclusive.

By order of the Board,
WILLIAM E. ROBERTS,
Secretary.

Offices: 63, Chancery Lane,
W.C., July 26, 1901.

LEATHERHEAD GAS AND LIGHTING COMPANY.

NOTICE is Hereby Given of Sale by TENDER of 200 SHARES of £10 each, being a portion of the Additional Share Capital authorized to be raised in pursuance of the powers of the Leatherhead Gas Act, 1901.

No Tender will be received after Eleven a.m. on Wednesday, the 14th day of August, 1901.

Forms of Tender can be obtained on application to the Secretary.

By order,
JOHN YOUNG,
Secretary.

Leatherhead, July 18, 1901.

CROMER GAS COMPANY.

ISSUE OF £10,000 ORDINARY STOCK.

THE Directors of the Cromer Gas Com- pany Hereby give Notice that they are prepared to receive TENDERS for £10,000 ORDINARY STOCK, to be issued under the provisions of the Cromer Gas Act, 1898, and ranking for a Standard Dividend of Five per Cent. per annum.

The last Dividend on similar Stock was at the rate of Four per Cent. per annum.

The Stock may be held in multiples of £1, with a minimum holding of £10, and will be registered in the Company's Books, and Certificates issued, free of expense.

Tenders must be delivered at the Company's Office, Cromer, on or before Friday, the 9th day of August, 1901, accompanied by a deposit of £10 per cent. on the Stock tendered for; the balance being payable on allotment.

THE RESERVE PRICE HAS BEEN FIXED AT CONSIDERABLY BELOW PAR.

Copies of the Company's Special Act may be seen at the Company's Office, and Particulars and Forms of Tender may be obtained of Messrs. Barclay and Co., Limited, Bankers, Lombard Street, London, and at Norwich and Cromer; or at the Company's Office, Cromer.

By order,
P. E. HANSELL,
Secretary.

Cromer, July 26, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

Net Price: Cloth Bound, 12s. 6d.; Morocco Gilt, 18s.

GAS COMPANIES'

BOOK-KEEPING.

A Practical Treatise on the Keeping of Gas Companies' Accounts.

By

JOHN HENRY BREARLEY & BENJAMIN TAYLOR,
OF LONGWOOD.

No pains have been spared by the Authors to make this book complete in every respect. The system of accounts recommended is not only a model of clearness, but also fully adequate to meet all reasonable requirements. Generally, the get-up of the book and of the various forms and specimen rulings shown therein is excellent. The work will be found both useful and reliable, while its convenience is greatly enhanced by the inclusion of an adequate index.—*The Accountant.*

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effects a great saving of time, labour, and expense.

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Can undertake the Largest Contracts.

HYDRAULIC BLOWER
For blowing Air into Gas Purifiers for the purpose of
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Full Particulars on application.
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Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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Highest Results in Gas, & Excellent Coke.

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HARDMAN & HOLDEN, LD.
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MADE from Spent Oxide (free from Arsenic) and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.
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Fitted with Steel
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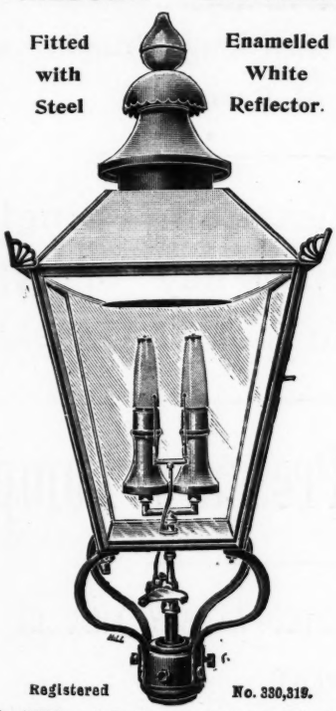

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DISPENSE WITH CANNEL COAL
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INCREASE YOUR ILLUMINATING POWER
by using the
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The Cheapest and Best in the Market.
The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.
Apply to the Sole Makers:
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Gas Companies are solicited to try Samples of the
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Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
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ALFRETON IRON-WORKS, DERBYSHIRE,
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Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

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Maintains a High Standard in Residuals.
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FOR
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RECOVERY OF SULPHUR,
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Full Particulars on application to the Patentees
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Yield of Gas per ton . . . . 13,155 cub. ft.
Illuminating Power . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.
Yield of Gas per ton . . . . 10,500 cub. ft.
Illuminating Power . . . . 17·8 candles.
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Yield of Gas per ton . . . . 10,500 cub. ft.
Illuminating Power . . . . 16·3 candles.
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SELF-INTENSIFYING LAMP.

Automatic Action.

No Complex Mechanism.

"Power" Free of Cost.

TYPE OF SCOTT-SNELL LAMPS
NOW IN USE
AT THE GLASGOW EXHIBITION.

INTENSIFIED LIGHT

WITHOUT Compressing Plant, Special Gas-Service, Water Bill, Gas-Engine or other Pumping Appliances, tearing up of Roadways, or interference with existing Service.

The **SCOTT-SNELL LAMP** may be set to give any pressure from **4 inches to 36 inches of Water; 8 inches to 10 inches is usually preferred.**

Lanterns supplied with Single, Duplex, or Cluster of Burners.

TO GAS ENGINEERS AND MANAGERS.

At the Stand on the North Bank of the Kelvin, an attendant will be pleased to give full explanation, and to show the action of the Lamp.

This unique Illustration of Wasted Bye-Products (heat in escaping products of combustion) effecting, without cost, all that is elsewhere reached by special motive power and special distributing Mains, should not be missed,

350 to 500 Candles from a Single Burner, with an efficiency of **35** Candles per cubic foot of Gas.

The ONLY High-Pressure Lamp.

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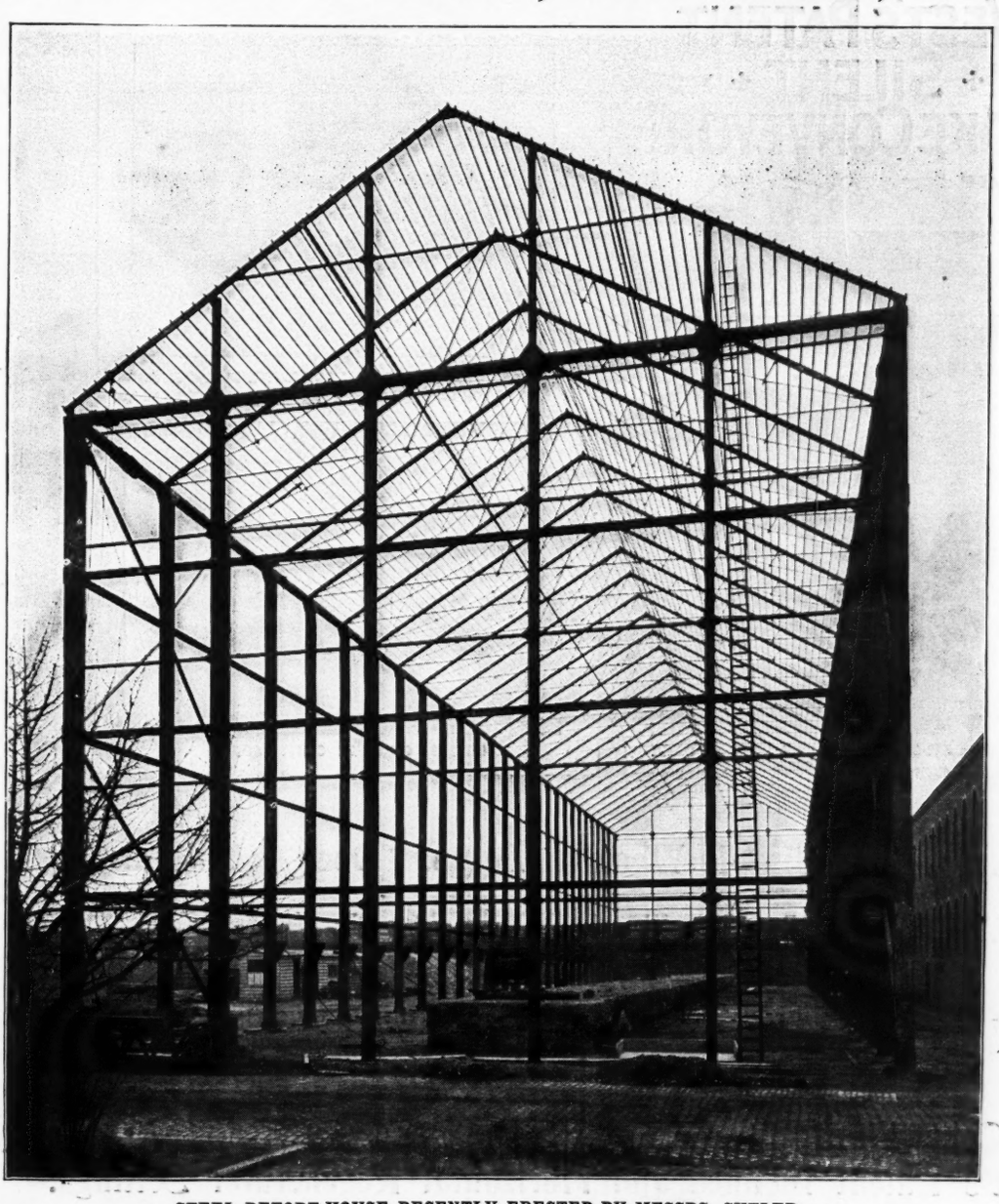

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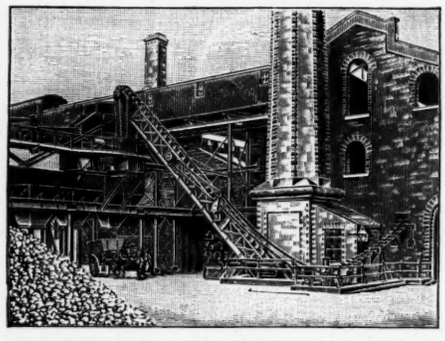
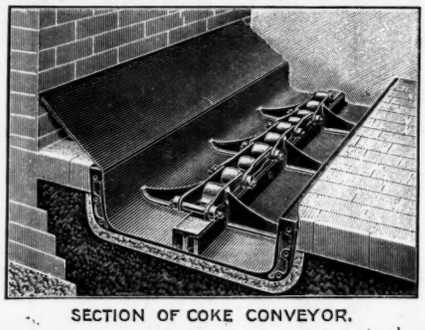


VIEW SHEWING END OF COKE CONVEYOR, ELEVATOR AND CONVEYOR FOR STORING COKE IN HOPPERS AND COKE YARD.

INTERIOR OF RETORT HOUSE SHEWING COKE CONVEYOR.



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Silent in Action. Simple Wearing Parts. Does not make Breeze.

SPECIALLY ADAPTED FOR CONVEYING, ELEVATING, AND STACKING HOT COKE FROM GAS-RETORTS OR COKE-OVENS.

The Conveyor after leaving the Retort-House may be arranged to rise up an incline to any required height, and the Coke delivered from the Conveyor to the Coke-Store from any part of the Conveyor.

ALSO MAKERS OF

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Coal-Handling Machinery for Gas and Electric Light Works.

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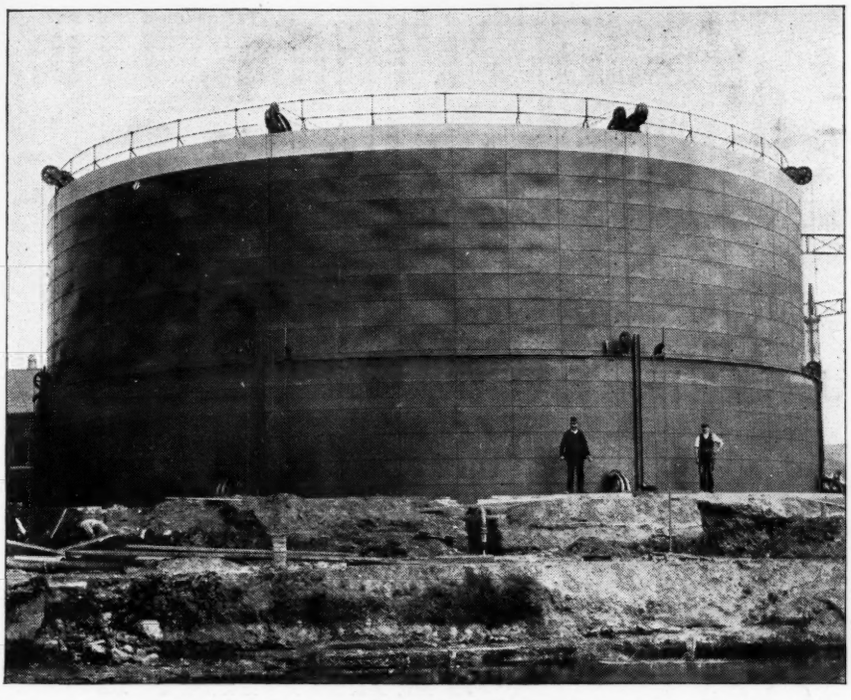

Two-Lift Cable-Guided Gasholder, 80 ft. diameter by 20 ft. deep.
STAFFORD CORPORATION GAS-WORKS. (*From a Photo.*)

COPY OF TESTIMONIAL.

CORPORATION OF STAFFORD,
GAS & ELECTRICITY DEPARTMENT,
STAFFORD, *Feb.* 9, 1899.

Messrs.
ASHMORE, BENSON, PEASE, & CO., LTD.,
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GENTLEMEN,

It affords me pleasure to state that our No. 2 Gasholder, from which you removed the outside Guide-Framing on account of it being defective due to the settlement of the foundations, and substituted your Steel-Wire Cable System for both Inner and Outer Lifts, has, since the alteration, **worked perfectly satisfactory.**

Its Stability and Rigidity under High Wind Pressures, when fully inflated, is such that it **preserves the level working of both Lifts, and gives a steady outlet pressure.**

I am, sincerely yours,
JNO. FERGUSON BELL,
Engineer.

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Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

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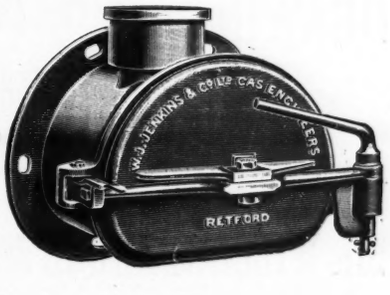

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Plans, Estimates, and full Particulars for Complete or Partial Erection and Renewal.

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BELLOWS made to inflate a 48-inch Bag under One Minute. Various sizes made.

Miners' Woollen Jackets No. 1, 12/- each; No. 2, 9/6.

Stokers' Mitts, from 13/6 doz. Made from best Tanned Leather.

India-rubber Hose, Sheet, and Washers of every description, Leather Bands, Oils, &c., Diving and Wading Dresses, Waterproof Coats, Capes, Sewer Boots, and Theatrical Dresses.

Fire-Engine Hose and Appliances.

Best Materials and Workmanship Guaranteed.

Gas-Bags for Mains. Gas-Engine Bags.

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Patent Automatic Machinery

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DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

[See Illustrated Advertisement, July 2, p. 61.]

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NITRATE OF THORIUM, CERIUM, AND OTHER SALTS

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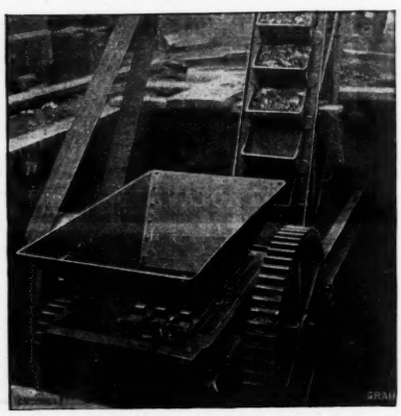
ELEVATORS & CONVEYORS.



INCLINED RETORTS.

PHOTO, SHOWING ELEVATOR FOR COLD COKE.

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STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, & ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible and other Stourbridge Clays.

Manufacturers of Glasshouse Pots and Crucibles of every kind.
Established 1836.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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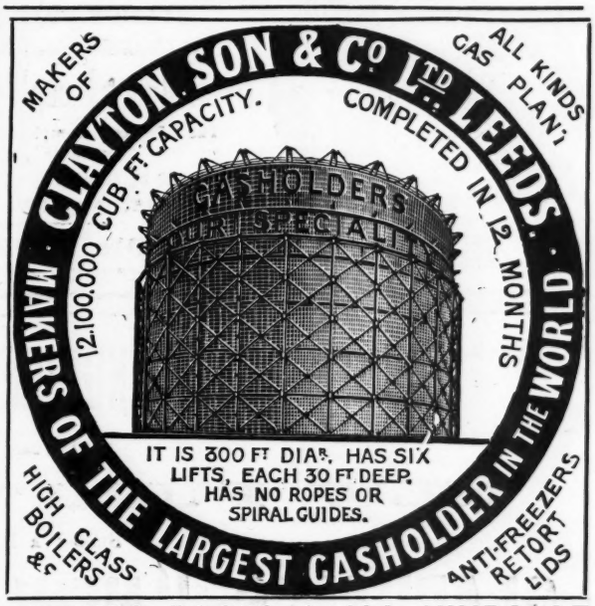
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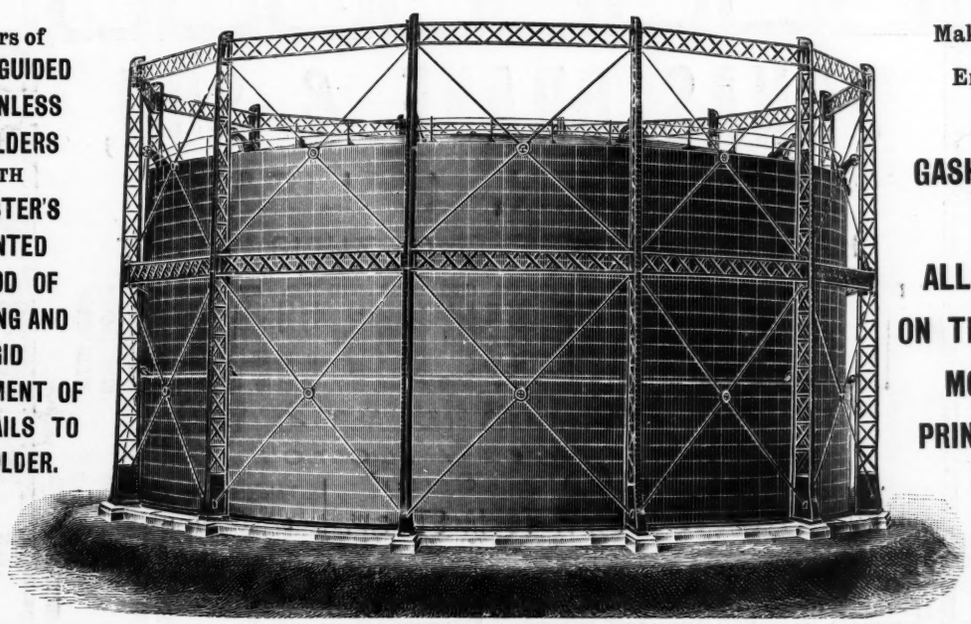

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